

R E P O R T R E S U M E S

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PROCEEDINGS OF THE NATIONAL CONFERENCE ON PROGRAMED
AUDIOVISUAL INSTRUCTION IN MEDICAL AND DENTAL EDUCATION, LOS
ANGELES, CALIFORNIA, APRIL 28-30, 1963.

BY- INGRAHAM, REX AND OTHERS

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES

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PROGRAMED MATERIALS, INFORMATION DISSEMINATION, LOS ANGELES,
CALIFORNIA

A NATIONAL 3-DAY CONFERENCE WAS HELD TO REPORT AND
DISSEMINATE INFORMATION CONCERNING THE USES OF PROGRAMED
INSTRUCTION AND ADVANCED AUDIOVISUAL MEDIA IN MEDICAL AND
DENTAL EDUCATION. THE REPORT ON THE CONFERENCE PROCEEDINGS
WAS ORGANIZED INTO FIVE SECTIONS. SECTION ONE INCLUDED THE
PAPERS PRESENTED AT THE CONFERENCE RELATING TO PROGRAMED
INSTRUCTION (NONMACHINE ORIENTED). SECTION TWO INCLUDED THE
PRESENTATIONS CONCERNING THE USE OF CLOSED CIRCUIT TELEVISION
IN MEDICAL AND DENTAL TRAINING. SECTION THREE REPORTED ON
AUDIOVISUAL PERFORMANCE AIDS. SECTION FOUR HIGHLIGHTED
AUDIOVISUAL PRODUCTION TECHNIQUES. SECTION FIVE INCLUDED THE
SPECIAL ADDRESS PRESENTED ON THE LAST DAY OF THE CONFERENCE.
PARTICIPANTS WERE ASSIGNED TO SMALL STUDY GROUPS AND DIRECTED
TO EVALUATE THE PRESENTATIONS AND REPORT THEIR CONCLUSIONS TO
A FINAL, GENERAL SESSION. THESE CONCLUSIONS, ALONG WITH
GUIDELINES AND RECOMMENDATIONS, WERE PRESENTED IN THE REPORT.
TWO OF THE MAJOR RECOMMENDATIONS WERE--(1) CENTRAL SOURCES OF
INFORMATION SHOULD BE ESTABLISHED FOR INFORMATION
DISSEMINATION RELATIVE TO ADVANCED INSTRUCTIONAL MEDIA AND
METHODS FOR MEDICAL AND DENTAL SCHOOLS, AND (2) PROVISIONS
SHOULD BE MADE IN EACH INSTITUTION FOR CENTRALIZED
AUDIOVISUAL FACILITIES AND A FULL-TIME STAFF. (JC)

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education

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PROCEEDINGS
OF THE
NATIONAL CONFERENCE ON PROGRAMED AUDIO-VISUAL
INSTRUCTION IN MEDICAL AND DENTAL EDUCATION

held at

LOS ANGELES, CALIF., APRIL 28-30, 1963

under the auspices of the

HUMAN FACTORS RESEARCH DIVISION
SCHOOL OF DENTISTRY
UNIVERSITY OF SOUTHERN CALIFORNIA
LOS ANGELES 7, CALIFORNIA

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* * *

September, 1963

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Foreword

One of the great cliches--but true, nevertheless--of our time is that we live in an era of technological change. Probably no groups could be more sensitive to this fact than the professional groups to whom this volume is addressed. Great changes have occurred in medicine and dentistry over a short period of time, and more are expected. Expectation for change in the fields of medicine and dentistry is reinforced by hope. Both the professions and the public want people to live longer and be healthy and happy in the process. Each new drug, technique or machine that can contribute to these great humanitarian objectives is greeted with open arms.

Innovation and change, however, are not necessarily treated the same way in all fields of human activity. In contrast to dentistry and medicine, education is viewed, too often, as an unchanging process. Further, both the public and many practitioners take a position, either conscious or unconscious, that education ought not to change.

The process of education cannot be walled off from technological change, in spite of the unconscious wish that it should stay eternally the same as it was in the golden days of our youth (and, of course, these days were more shiny golden than those of the youth of any other place or time). One of the great ironies is that the general process of technological change in our culture--for example in dentistry and medicine--absolutely demands that change occur in education. If, for example, all of the research in medicine could be stopped forever, we could put some kind of a ceiling on the amount to be learned and then we wouldn't have to worry about finding more

efficient ways to teach (and learn). But the research cannot and will not stop. Subject matter continues to be generated for the good of mankind. And the knowledge mounts and changes.

It is a characteristic of a technological culture that it seeks technological solutions to the problems created by its own science-technology complex. With more to teach more people and no more time to teach it in, we have come to this point in education. Further, the educational process itself is, by comparison, still at the point medicine was when the surgeon was also a barber.

However, the processes are at work, and education is undergoing great changes and an explosion of knowledge about itself. It is the process of becoming more scientific; it is, in the means at its disposal, undergoing a technological revolution.

Now the doctor or dentist who teaches is two men. He is a healer and a teacher. As healer he has welcomed changes and tried out innovations. He has had, almost literally, to run to keep up with the healing arts. Now, as teacher, he must face the same problem with the process of education. He cannot be a cultural schizophrenic, seeking innovation on one hand and rejecting it on the other.

This concept, it seems to me, lies at the heart of the symposium presented in these pages. For, while we are no longer so naive as to believe that there is a one to one relationship between communication and innovation, it is also true that innovation cannot proceed without communication. Within these pages the medical and dental educator will find much information relating to technological innovation applied to the teaching process--to his function as

teacher. If he is to forward his art of healing, he must also struggle with the problem of moving ahead his other art of teaching, and he will find help here.

James D. Finn, Ph.D.
Professor of Education
University of Southern California

P R E F A C E

This conference has as its major purpose the dissemination and exchange of information on the use of advanced educational communication and teaching media for the healing arts. There are several basic needs in the dental and medical profession which call for such a conference, and point out the necessity for improving instructional communication.

First, there is the problem of increasing the number of doctors of dentistry and medicine. For example, there is only a net gain of only 712 dentists in the country per year to care for an annual population increase of around three million. A similar problem exists in the medical field. Compounding the problem is the critical shortage of qualified instructors who face an ever increasing burden of crowded curricula. Then there exists the problem of postgraduate training for the busy practitioner who strives to keep pace with new advancements in his field.

It seems logical that the new technologies in communications, the techniques, methods and devices can be successfully applied to some of our problems. As dental and medical educators, we must become familiar with these new tools, know their limitations and learn how they can assist us in our tasks. For this reason, the key leaders in medical and dental, as well as in selected industrial instruction, have been brought together to foster the learning and application of these new methods.

The purpose here is to establish guidelines for the exchange of ideas and to evaluate the newer techniques in communications for dentistry and medicine, and to make available the proceedings of this conference to a wider audience of dental and medical educators.

This conference is unique in dental and medical education. As far as we know, this is the first time that a select group of dental and medical educators have come together on a national basis for such a purpose. The participants are unique in that, not only are they conducting research, but they are applying the findings in their respective institutions to help resolve some of the communication and instructional problems they face.

Since this was a first conference, it seemed appropriate to have several general sessions...in order to become acquainted with the diversification of research being conducted. It was for this reason that study sessions were held near the conclusion of the conference, whereby specific instructional communication techniques could be considered, evaluated and reported. Each participant was assigned to one of the study sessions...a total of four sessions were planned: 1) Teaching Machines and Programed Learning; 2) Closed Circuit Television; 3) Self-instructional Audio-Visual Training Devices; 4) Techniques of Audio-Visual Media.

A chairman and co-chairman were assigned to each group for the purpose of directing their efforts toward evaluating the presentations and reporting their conclusions back to a final, general session. These conclusions are found in section VII of the report.

The conference and the subsequent publication of the papers of the conference are made possible by a grant from the United States Office of Education, to whom we are indeed grateful.

Rex Ingraham, D.D.S.
Professor and Head,
Department of Operative Dentistry
Conference Chairman
University of Southern California

Norman Topping, M.D., President, University of Southern California

It is a great delight to welcome you here. For you who do not know the University of Southern California, this is a private institution that was begun in 1879; the first building was completed in 1880. That doesn't sound very old compared to Harvard's 1636. However, our beginning is significant for several reasons, and among these is the enthusiasm which greeted us. When our first building was dedicated, the population of the City of Los Angeles was only a little over 10,000 people. Ten percent of the population were sufficiently interested in higher education to witness the dedication of our first building. I have often wondered what would happen the next time we hold a dedication if ten percent of the population of Los Angeles were to come. Our first building is still here. It is now an historical monument of the State of California as the first building for higher education in the southern part of the State.

I know that this conference will be very productive. As a member of the health profession, I am particularly proud that medicine and dentistry together have really been leaders in the field of closed circuit television and other audio-visual aids for teaching. Now I see that we are going to undertake leadership in a very important field--that of programmed learning.

I think the further development of these various devices for instruction will enable the faculty members to give more time to aspects of teaching which are more important than the dissemination of facts. The further development of these devices for instruction will also give the student an opportunity to have facts programmed so that the faculty and the students will not be involved in routine

fact discussions but will have time to discuss much more important issues, including the philosophy of our professions, the history of our professions, studies and thoughts of the future in depth.

I believe our professions are particularly vulnerable when they spend so much time trying to have the students acquire facts through instruction that not enough thought is given to the critical problems where our professions fit into our society; what will be the future of our professions; and how we, as professional people in the health services, are going to provide the necessary health services to the population as it is tremendously increasing.

In the next ten years, we may find that the medical and dental professions will not be able to provide the needed essential health services. We are seeing this in nursing now, and I'm sure that you are all familiar with some of the other serious problems that face our professions over the next ten years. However, it is the purpose of conferences of this kind to help find the answers we need, and I am confident indeed that the work of this conference will yield significant results. Again, on behalf of the University of Southern California, let me extend to you a most sincere welcome.

Robert W. McNulty, D.D.S.
Dean, University of Southern California School of Dentistry

Approximately five years ago a group of four individuals, faculty members, came to my office by appointment, which is somewhat unusual, and approached me with the proposition of beginning a research program in human factors in dentistry. The human factors in dentistry did not mean very much to me and I needed a good bit of explanation. As they proceeded to explain, the idea became more interesting and I asked them to set down on paper their objectives, what they intended to do and just exactly how they expected to do it. When I got this material in written form I was more interested and gave my approval for the beginning of such a project. These men began to work and for the past five years they have been working hard. One of the first problems was to find space for them. We were aware of the fact that an addition was to be made to our dental building which would provide space, by vacating what then had been our library for this particular project. It is now equipped. This group of four individuals, Doctors Ingram, Tanner, Golden and Edison, have organized this particular endeavor. They have gathered about them architects, engineers, physiotherapists, psychologists, physicians, people from all walks of life that might have some ideas and some influences on those human factors which affect the relationship between the dentist, or which affect the dentist, the patient, and the relationship between the dentist and the patient. This conference is the second to be held under the auspices of the human factors division. I appointed as the principal investigator in this project Dr. Rex Ingraham, who is the Chairman of our Department of Operative Dentistry, and who will act as Program Chairman.

PRESENTATIONS TO CONFERENCE

Section I Programed Instruction

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The Hollywood Museum

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Section I

PROGRAMED INSTRUCTION

EXPERIENCE WITH PROGRAMED INSTRUCTION IN
BASIC MEDICAL SCIENCE

by

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Abstract

The beginning medical student must absorb a vast amount of factual information, which consumes a large part of the student's time and drudgery involved in rote memorization of large numbers of facts.

Programed instruction should assist the student to learn more, or to learn the same amount in less time, with less pressure.

Based on the results of a program in one course in Parasitology which was encouraging, further experiments with programs in other basic disciplines are justified.

The work in programed instruction at Dartmouth has been under way since 1960, when Dr. Robert Weiss, Professor of Psychiatry, and Dr. Edward Green, Professor of Psychology in the Medical School and College, began a research project sponsored by the Carnegie Foundation on the effectiveness of programing in the teaching of basic medical sciences. This research has not been directed primarily at novel types of programed instruction but rather toward attempting to evaluate the effectiveness of these tools in meeting some of the special problems of medical education. Some of these special problems are, first: the tremendous and ever increasing amount of factual

information which the beginning medical student must absorb; second, the consequent and also increasing demand on the student's time which this imposes; and third, the downright drudgery involved in rote memorization of large numbers of facts. Put in another way, if programs are to justify the considerable investment of time and expense involved in preparing them, it would seem to us that they must at least accomplish one of these three things: They must help the student to learn more, or to learn the same amount in less time, or at the least, to learn the same amount in the same time with less pressure. These objectives will explain the methods of evaluation which I'll presently describe.

But first I might mention the way the programs have been prepared. They have been a collaborative effort by various interested members of the faculty with Dr. Green and his able staff of program editors, under the overall supervision of Dr. Weiss. One of the weaknesses of some programs, it has seemed to us, has been that though they are technically good and contain no misinformation, they lack a wise selection of material and the focus which only an experienced teacher on the particular subject can provide. Therefore, the teachers of the various basic science disciplines have worked actively with Dr. Green and his staff in preparation, editing and evaluation of the programs so far prepared. These include programs in parasitology, the autonomic nervous system, and biochemistry. Programs in gross anatomy and neuro-anatomy are in preparation. There has been experimentation in various ways of using these programs, which include requiring the student to complete a program before attending lectures and laboratories, substituting the program for courses previously taught entirely by lectures and assigned reading and, finally, by requiring students

to complete sets of material before undertaking formal study in the course.

The evaluation of the effectiveness of the programs has also been carried out in various ways. But I shall describe only the methods used with the parasitology course, on which we have the most complete data.

The class was divided into two groups A & B matched for ability on the basis of class standing at the end of the previous year. The course was divided into four parts, for each of which a program was prepared. Each class group alternated programed and non-programed text material through the four parts of the course.

A basic examination was given at the end of the course. The questions were keyed so that it was possible to tell if the information derived from the student's answer came from the programed or the non-programed material. The students kept a time record of the amount of time they spent on the course between the programed and non-programed instruction.

A complete report of the results of the experiment with the parasitology program is given in a paper written by Drs. Weiss, Green, and Philip O. Nice.¹ To summarize briefly, analysis of the examination results showed programed study to produce test performance significantly superior to nonprogramed study. Further, a comparison of program vs nonprogram test scores of the top five and bottom five students in the class showed that, although the scores of the top five students were higher with programed study, they were not significantly

¹Green, Edward J., Weiss, Robert J., and Nice, Philip O. The Experimental Use of a Programed Text in a Medical School Course. Journal of Medical Education, 37:767-775, August 1962.

so. However, the higher programed study scores of the bottom five were statistically significant. In addition, it was noted that programed study had raised the performances of the poorer students to a level of achievement equal to that of the more able students.

A second finding showed that efficiency of programed study was greater than nonprogramed study; that is, a high score was attained with less study time on the program than with study by conventional methods.

Now the question that we next considered was whether or not the program we had designed for our students would work equally well for other students. The reason for considering this was that our own medical students are a rather special highly selected small group with very high ability, and we wondered whether or not this same program designed for our high ability students would work equally well with others of lower capacity. We therefore had the program tested at two other medical schools. Medical School X is a large New England medical school of good, high caliber students, though not quite so highly selected as ours. Medical School Y is a large southern medical school with students of a still lower capacity.

The average Dartmouth score on the examination was 81% correct on program material, 71% on nonprogram material. The average score for Medical School X on the same examination was 75% correct on program material vs 69% on nonprogram material. Medical School Y averaged 69% correct on program material, 63% correct on nonprogram material, also on the same examination. All of these differences are statistically significant.

This course in parasitology is the only one so far in which we have this much information. We are in the process of getting

evaluated data on the other courses which I mentioned. My own experience with programing began in December, 1962, when Dr. Weiss asked my help in preparing a program in neuro-anatomy. Here is a subject of great complexity which traditionally has been one of the medical student's worst headaches. Because of the complicated and often poorly understood structural and functional relationships of elements to each other and the sheer numbers of elements to be memorized, it would seem to be an ideal field to program, if it could be done well. We decided to limit ourselves to a basic program covering a portion of the course. In practice, one of the easiest parts of the nervous system for the student to understand is the anatomy of the spinal cord. One of the most difficult is the anatomy of the medulla. In the Dartmouth course, as in most others, these two parts are the first ones given detailed study. To prepare two programs on these two parts would give us the advantage of a project of manageable scope and one which would give us a chance to compare the effectiveness of programing relatively simple and relatively complicated material. To begin with, I read a small bibliography recommended by Dr. Green on the basic principles and techniques of programs. One of the most valuable things I learned was the importance of drawing up a detailed and specific list of objectives for the program, in the form of a statement of exactly what the student was expected to be able to say or write and to do after completing it. To go through this exercise was a most useful piece of self-discipline, which I would recommend to any teacher who hasn't tried it. It's slightly embarrassing to find out how hard it is to write down exactly what you expect from your students. Perhaps it's because you keep hoping that they'll learn more than you teach them, and of course, some of them do.

The next step is to write a brief text composed of simple, clear, declarative sentences. This, too, is not quite as easy as it sounds, and it brings to light a surprising amount of evasiveness and ambiguity in standard references. Since it is inconceivable to teach neuro-anatomy without visual aids, and since one objective was to teach the students to draw simple diagrams showing the elements and their connections, the incorporation of these aids was an interesting technical challenge. The method used was a series of outline diagrams, with one new element to be added by the student in each frame. The identification of structures in microscopic sections, another objective, was managed by the reproduction of photomicrographs with pointers on which the student provides labels. On this point, the material was turned over to Mrs. Joan O'Connell, one of Dr. Green's assistants, who made the frames from the text and who prepared the actual program. I don't want to skip lightly over this part of the job. The work of a skilled program editor is an essential if you're going to attempt this kind of thing.

This program is now being tested by a method essentially similar to the one used in parasitology. We have given the spinal cord program to half the class, matched with the other half on the basis of past performance. All the students have kept a record of time spent studying. Those with the program divided the total into time with the program and time on all other study. Aside from the program, which one group is requested to complete, the content of the course is the same in both groups. Those involved in teaching this portion of the course have not seen the program. The students have just been given an examination on the spinal cord, which was set by an examiner who had neither participated in the course nor seen the program.

At the present time, those who did not have the spinal cord program have been given the one on the medulla. An examination on the medulla will be given to both groups in the course when work on this region has been completed. As in the parasitology evaluation, we will therefore have a chance to compare ability matched groups on performance with programed and non-programed material and, also, can use each student as his own control by comparing his performance with the program against the performance without. The results of this evaluation are not yet available.

In conclusion, we have evidence based on the results of a program in one course, parasitology, which is encouraging enough, we feel, to justify further experiments with programs in other basic disciplines. At the moment, we are lacking in hard evidence as to the value of these other programs. We are a little concerned at the over-enthusiastic response which has greeted this one successful venture. We do not believe that programs alone will supplant conventional methods, except perhaps in some cases, for basic textbooks. We are turning away from programs involving whole courses towards smaller units dealing with problem areas, which can be used more flexibly and, perhaps, may be useful in more than one course. We do not believe that programs will solve in one stroke the problems of medical education. To date they have raised more questions than they have answered. It seems to us that much more time and experience are needed before the full potentiality and limitations of this promising instructional method can be defined.

PROGRAMED TEXTBOOK IN ORAL HISTOLOGY

by

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Abstract

While many programs were meant to be used in teaching machines, preliminary research now suggests that some programs can be presented on the pages of specially designed books called programed texts. The object of this study was to determine if the use of programed texts was applicable to the course in Oral Histology. Is the material learned as effectively as in the lecture and seminar methods of presentation? And is the material retained to a greater or lesser degree?

Three control groups of students were given the same material, but by the separate methods of lecture, seminar, and programed texts. The results thus obtained will determine the feasibility of programming the remainder of the course, thus opening new instructional practices to supplement the present methods of classroom presentation.

The increased demands being put on our educational system have prompted educational theorists and researchers to investigate new techniques of teaching to increase both the efficiency and the effectiveness of their teaching. A new teaching technique is rapidly

evolving, and, while the technique is still in the early experimental stage, it has been given much publicity and has stimulated considerable discussion in some educational circles. The term "Programed instruction" is probably best suited to cover this new technique, although to the layman it is most commonly known as teaching by "teaching machines", through devices which are sometimes used to present to students instructional material in programed form. Interest in the subject has been high because of some early reports which maintain that programed instructional techniques have enabled some students to learn faster and retain better what they have learned than control groups studying comparable subject material in classes taught traditionally.

In the Dental School curriculum increased demands for the inclusion of new courses and materials have necessitated a re-evaluation of the existing teaching techniques to determine if there are more efficient and effective means of instruction to lighten the hour load of the curriculum on the students. One of the techniques being considered in place of the traditional classroom lecture recitation presentation is the programed instruction method of presentation.

A program is a body of specially organized instructional material designed for independent study by a student. While the first programs were meant to be used in teaching machines, preliminary research now suggests that some programs can be presented with equal effectiveness on the pages of specially designed books (Eigen and Komoski, 1960; Roe 1960). These specially designed texts are called Programed texts. The current widespread interest in programed instruction and teaching machines can be attributed to the influence

of B. F. Skinner of the Harvard University Psychological Laboratory. Work directed by Skinner in the 1950's and articles which he published in 1954 and 1958 attracted considerable public attention and, together, probably provided the stimulus for the so-called "new movement" in education. The original pioneer in the field of teaching machines was S. L. Pressey, who, working at Ohio State University in the 1920's and early 1930's, published a series of articles on the development and early utilization of mechanical devices which could "test, score, and teach". The title of his paper published in 1932 illustrates his orientation: "A Third and Fourth Contribution Toward the Coming 'Industrial Revolution' in Education". Although we place considerable importance on these studies of Pressey and his students, his work went largely unnoticed at the time. His industrial revolution failed to come to pass, and his ideas seemed to die during the depression.

By 1958 the post-sputnik climate seemed to be more favorable for experimentation, radically departing from traditional educational practice. The relationship and equivalence between teaching machines and the programmed text has been clearly established (Honne and Glaser, 1959; and Lumsdaine and Glaser, 1960). There are two main schools of thought regarding programming techniques; one advocates the linear program format, the other the branching program format. Writers of linear programs maintain that a student's behavior can be best shaped by leading him through a carefully planned progression of steps in a specified sequence. It is felt that if the sequence is properly constructed, then the student will seldom make an inappropriate response. The student thus receives frequent positive reinforcement for his responses, and this

reinforcement, according to current theory, aids in insuring efficient learning.

Advocates of the branching technique maintain that since no two students are alike, that it is logical to provide many alternative routes or pathways through the programmed material to accommodate for individual differences in behavior pattern (Crowder 1960, and Pask 1960). Thus if the program is too difficult for the student, alternative remedial pathways are offered the student to bring him to the point of being able to proceed with the main body of the program. These remedial pathways may cover much the same steps as the direct pathway through the program, but the material is presented in smaller, easier to master steps. Branching programs are more difficult to prepare than linear programs. The linear programists maintain that it is wasted effort to prepare these branching programs since linear programs can be established for each ability group. The resolution of this linear versus branching controversy is the subject of considerable current research, with the solution of this dilemma not yet in sight.

Meanwhile, very little research has been conducted and reported on the relative effectiveness of programmed instruction versus the traditional classroom lecture presentation method. It is reported that students in the first grade can be taught scientific theory and the ability to interpret scientifically physical phenomena (Keislar and McNeill, 1961). Two studies have reported that the programmed technique is as effective as the traditional method of presentation in an introductory college Psychology course and a military science course (Silberman and Coulson, 1959; and Hosmer and Nolan, 1960).

These reports also noted that the material was covered in a much shorter period of time in the programmed presentation; and, that the smaller the steps the easier it is to learn the subject matter.

The objective of this research proposal is to determine if the efficiency and effectiveness of the programmed instructional technique is applicable to the course in Oral Histology as offered at the College of Physicians and Surgeons Dental School, San Francisco. It is hoped that this study can answer the following questions: (1) Is the material learned as effectively as in the lecture and seminar methods of presentation? (2) Does this method require more or less student classroom time? (3) Is the material retained to a greater or lesser degree when learned by the programmed method of instruction?

The Independent Variable to be tested in the method of instruction (i.e. lecture, seminar, and programmed); the dependent variables to be investigated are: (1) post-test scores of achievement and (2) length of time to perform instructional method. The hypothesis to be tested among these variables take the following form:

1. There is no difference in the differences of the means of the mean scores attained from the pre-tests and post-tests for the three methods of instruction when equivalent subpopulations are investigated.
2. There is no difference in the mean time needed for the three equivalent subpopulations to progress through the three methods of instruction.
3. For equivalent subpopulations there is no difference in the differences of the means of the mean scores attained from the pre-tests and from the post-test, when the post-tests are readministered at an interval

of six months from the date of completion of the instructional method, as they are instructed by the three methods of instruction.

By equivalent subpopulations is meant selecting groups from the total population to be tested so that we can equalize any relevant variant that appears in the groups. An example of a relevant variant to our study would be intellectual ability. This can be equalized by so selecting our groups as to match for intelligence or carry the difference of intelligence test scores through the experiment.

The experimental design will be utilized to test the hypotheses of this research proposal. The experimental population will be the freshman class at the dental school. The class will consist of either 58 or 60 students; the size alternates every year due to space and facility limitations at the college. The populations consists usually of all males who have a minimum of three years college training; with an average age of 24 years, and 60 to 70% having attained the bachelor degree. One or two of the members of the populations will have earned a master's degree; 30 to 40% of the population will be married.

The students will be enrolled in the course in Oral Histology in the second of the three ten week quarters of the Freshman Year. The first three class sessions will be devoted to administrations of evaluation instruments. The first session will be spent in the administration of the Miller Analogies Test; the second class session will be spent in the administration of an Oral Histology Achievement-Ability Test; and the third session will be utilized in the administration of a comprehensive test of the student's knowledge of the periodontal membrane (this constitutes one of the twenty lesson units of the course).

A Crowder type branched programed textbook has been prepared with the cooperation of the Stanford research Institute on the subject of the periodontal membrane. In the normal course of instruction the subject of the periodontal membrane is covered in a single hour lecture. This research will consider only this unit of instruction and not the entire course because of the enormity of preparing a branching textbook. It required four workers some three months of intensive work to program a single unit of the periodontal membrane. It does not seem feasible at this time to program the remainder of the course without some preliminary testing of this one unit.

The students will be randomly divided into three groups from triads of matched groups that are matched on the basis of scores on the Miller Analogies Test. Once the groups have been selected, then an analysis of the past academic record as found in achievement in their college transcripts, age, scores on the aptitude test for histology can be made. Any significant differences noted in respect to these variables can be carried through the experiment where applicable to the dependent variable.

Group I will be given the programed textbook on the periodontal ligament to read on the fourth day of the class. At the same time, but in a different classroom, the members of Group II will be given a fifty-minute lecture on the periodontal ligament. The lecturer will be specially trained for three to four weeks so that he can effectively deliver and explain all the material as contained in the programed textbook. At the same time, but in a third classroom, a seminar type presentation of the periodontal membrane will be held with Group III. An instructor well trained in the seminar method will be instructed and observed by a group of the faculty in practice seminar sessions on the periodontal membrane.

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On the fifth day of the quarter all the students will assemble in the same room and will be administered a comprehensive examination of the student's knowledge of the periodontal membrane. Six months from the day of this test the post-test will be readministered the entire class when assembled in the same classroom as a single group.

The analysis of the data will either confirm or reject the hypothesis as stated for this particular group studied. With acceptance or rejection of the hypothesis will be the acquiring of some insight into whether the branched type textbook is effective in teaching the histology of the periodontal membrane, difference in length of time to utilize the textbook for this unit of study, and some indication of the retention of histologic information learned by this method. The results thus obtained will determine the feasibility of programming the remainder of the course and its subsequent use in experimentation. The results will also indicate whether this approach has an applicability in the teaching of Histology at the college, thus opening new instructional practices to supplement the present methods of classroom presentation at the Dental School.

PROGRAMED LEARNING IN THE TEACHING OF
DENTAL ANATOMY

by

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Abstract

During the past three years the University of Oregon Dental School has worked with the Center for Teaching Research of the Oregon State System of Higher Education in the application of programmed learning principles to the teaching of dental subjects. A programmed syllabus covering a short unit in the teaching of dental anatomy was constructed, and a pilot experiment is in progress to determine its efficacy compared to usual dental anatomy laboratory teaching. Aims are to discover whether or not there are any possible savings of teaching time, increased learning rates, and reaction of students and faculty to programmed methodology.

It is the philosophy of the University of Oregon Dental School that the dental faculty as a whole should have a knowledgeable working acquaintance with the principles of the teaching machine and programmed learning as preparation for efficient work with expert programmers when applying programmed principles to respective teaching areas.

This summer, there has been arranged by the Teaching Research Center of the Oregon State System of Higher Education conferences and workshops for professional teachers and administrators whereby they may be thoroughly acquainted through inservice study and formal course preparation in the principles of practical programming.

Representatives of the University of Oregon Dental School faculty will be in attendance. This, it is believed, will make possible thoughtful and effective application of the "newer methodology" to other didactic and clinical areas in this school's curriculum supported either through research grants or individual faculty initiative. The possibility is held that if, with the new media curricular time may be saved with increased efficiency of teaching, that this saved time can be applied for the future inclusion of selected objectives stressed by the recent Survey of Dentistry, with a special view to those of human relations, "social" and "psychological" dentistry.

PROGRAMED LEARNING IN THE TEACHING OF DENTAL ANATOMY

During the past three years, the University of Oregon Dental School has worked with the Center for Teaching Research of the Oregon State System of Higher Education in the application of programed learning principles to the teaching of dental subjects. The crown and bridge department has taken the lead to program four units from the course in dental anatomy, the content focusing on basic dental anatomy terminology. No actual machines were used. A program syllabus was constructed following generally the principles of linear and branching approach. Appropriate visual aids were included as a part of the project, these being in the form of overlays showing progressively the structure of the tooth with labeled terminology. Regular dental anatomy laboratory models were also available. The

pilot experiment presently is financed by the University of Oregon Dental School and the Center for Teaching Research of the Oregon State System of Higher Education.

Objectives were the possibility of saving lecture and laboratory time, of increasing learning rates, and of discovering the problems of programmed learning administration, including those of faculty and student morale. Also of concern were guidelines for future programmed learning application within the dental curriculum; as example, if only particularly difficult units of course work should be programmed versus programing the whole course. As the study continues, a particularly pertinent objective will be to learn how dental faculty wishing to experiment and apply the principles in programmed learning may best develop their understanding and skills for the art of programing, and what may be the best working relationship between the expert in subject matter and the expert in programing.

Method

Oregon's approach to building the dental anatomy experimental units has been, first, to generally acquaint the dental faculty with the principles and procedures of programmed learning through an inservice orientation conducted the past two summers, where principles and latest research have been conveyed by authorities in the field of programing, and where a considerable number among the dental faculty have gained limited practice in actual programing. Result of this orientation has been to develop a climate of openminded curiosity for the new methodology, and it is believed it has made the dental anatomy pilot study more possible of objective analysis. However, when actually constructing the four dental anatomy experimental units, authoritative programers from the Center for Teaching

Research of the Oregon State System of Higher Education worked with Dr. Robert Lang who heads the dental anatomy teaching, with the latter serving as subject matter authority and the Teaching Research Center as the actual programmers.

Tentative Observations of Program Results to Date

The only observations that can be reported at this date are the results of an informal use of the four units with the freshman dental anatomy class during the fall term, 1963, when the class was used as a group for "debugging" the program as a step in developing validity and reliability. Students used the program and the visual aids under faculty supervision. Doctor Lang has reported from his general observation that in this first use, students took only four clock hours to learn the subject matter for which a former class covering the same unit subject matter by lecture method required 12 clock hours. Warned is that this tentative observation was based on comparisons with prior classes' examination and performance records; and while the pilot experiment was under the same instructors as with previous course work and similar examining techniques were used for both groups, the reported results nevertheless are not based on controlled research.

Other general observations have been that students showed good interest, and faculty interest has been sustained and encouraging. The only possible adverse reaction has been that students using the program occasionally ask other course instructors when they were going to program their courses since most students felt the new methodology should be commended.

Whole Faculty Inservice -- Prerequisite to Optimal Success

It is the philosophy at the University of Oregon Dental School that future applications of the teaching machine and programing of instruction must be led on a foundation of thorough-going educational research making application to several divisions of the dental curriculum, as for example, to didactic, technical, and clinical divisions of curriculum; that the dental faculty must be more thoroughly informed of principles and procedures of programing when working with expert programmers. It is significantly important that the whole faculty should be inservice-educated for a knowledgeable and open-minded understanding of the possible values of the new media and to prevent uninformed negative comment creating an adverse attitudinal climate for experimental study.

It has been the experience during a period of 17 years of faculty inservice that unless the majority of the faculty representing most of the curricular divisions become reasonably knowledgeable in educational procedures, unnecessary difficulties may arise for an individual faculty member who is attempting to apply a new procedure. This difficulty emanates probably because those not knowledgeable in the new procedure used by another instructor naively or intentionally express negative views and general skepticism which, like contagion, spreads to students and other colleagues, with attending distortions of rumor and misunderstanding often adversely affecting the goals, methods and general climate of teaching for the instructor showing initiative in a new media.

The view is held that for maximum success of teaching machine and programed learning experiments in any institution, prior inservice education of the whole faculty is essential, and

experimentally-controlled results are often influenced adversely by the very fact that the climate of educational knowledge and open-mindedness was not established for the whole faculty prior to experimental efforts. For this reason the University of Oregon Dental School, in future study of the effectiveness of programmed learning in dental education, is encouraging representatives from the major departments of the dental school to continue intensification of their understanding and practical abilities for programing instruction. The Teaching Research Center of the Oregon State System of Higher Education for the past two or three years and continuing this summer has provided a number of conferences and workshops on the teaching machine and programmed learning where the faculty from all levels of education have or may, during a two-week to one-month workshop at the graduate level, increased their knowledge and skill for constructing, under expert guidance, programs for particular teaching. This summer, the prospects are that about 8-10 members of the dental school faculty will attend summer graduate course workshops of similar nature. In this manner, key faculty will be better prepared to view the new media objectively as it may be applied in different divisions of dental teaching and they will, with greater facility, be able to begin limited experiments within their own teaching. This preparation, in addition to past inservice on the same subject, will augment a climate of receptiveness, objectivity, and enthusiasm which will be to the advantage of Oregon's future plans.

Future Research Plans and Objectives

The University of Oregon Dental School is sufficiently interested in the possibilities of the newer methodology that steps have been

taken to continue on a slowly-paced basis certain limited and instructor-conducted experimental applications of programmed learning to newly-selected units of subject matter, as have been exemplified in dental anatomy. These limited experiments will be conducted largely without research grant aid.

A second research phase is planned for thorough-going investigation supported by a grant agency. This research is contemplated to extend over a five-to-seven-year period with the hope to carefully test applications to each of the major dental curricular divisions. One objective of intensified research will be to ascertain the possible extent to which learning through teaching machines and programs can be transferred by the student from, example, the theoretical curriculum to practical clinical and diagnostic and treatment situations. So far, the literature reveals little concern for this objective but it is a most vital one for dental education.

A major objective, in addition to those previously mentioned, will be to couple any savings of time shown, with the construction of new programmed courses aimed toward meeting the objectives stated by The Survey of Dentistry; particularly those objectives for developing the human relations, "social dentistry", and professional practice abilities and understandings of dental students.

The optimistic view is held that the "new methodology" may be an effective step forward for the improvement of one of dental education's major problems--lack of curricular time--and that the newer methods may make possible not only more efficient instruction in usual dental courses, but also for a fresh and efficient approach to those neglected objectives of human relations and social dental education to which dental educators clearly point vital necessity if dental education is to advance in human service.

FACULTY ATTITUDES TOWARD TEACHING MACHINES
AND PROGRAMED INSTRUCTION

by

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Abstract

As teaching machines and programs have been introduced in schools in ever-increasing numbers, educators and psychologists have become concerned about how programed instruction can be effectively used under actual classroom conditions. Their concern is reflected in such practical questions as the following: What is the role of the teacher? How can programed instruction be successfully integrated in the overall educational program? Can programed instructional materials be effectively used at home as well as in school? Do we need a machine to present the programs? One of the most fundamental questions involves faculty attitudes toward this method of instruction.

Training faculty members in the knowledge and use of programed materials could prove to be one of the most important objectives of a medical or dental school's staff in-service training program during the next few years.

FACULTY ATTITUDES TOWARD TEACHING MACHINES
AND PROGRAMED INSTRUCTION*

Introduction

Most of the early research studies in programed instruction were primarily concerned with the testing of instructional programs and the experimental use of a variety of teaching machines. The research was conducted in laboratory setting by psychologists interested in instructional method comparisons and a variety of psychological variables which are considered important in the programing of instructional materials. The procedure of developing, testing, and revising instructional programs deliberately kept teacher participation to a minimum, so that the programs could be assessed on their own merits. The teacher's role was that of an interested observer (Gotkin and Goldstein, 1962).

However, in recent years, as programed instruction has moved out of the laboratories and into classrooms on a large scale, research efforts have extended beyond investigations of the psychological variables to include utilization questions. According to a recent survey (Center for Programed Instruction, 1962), there are

* This paper is based upon a portion of the author's unpublished Ed.D. dissertation entitled, "A Study of Elementary School Staff and Student Attitudes Toward a Semi-Automated Instructional Program in Spelling". The complete study is on file at the Library of Teachers College, Columbia University, and was submitted in partial fulfillment of the requirements for the degree of Doctor of Education in that institution on January 14, 1963.

In this paper, the term "attitude" is used to denote ideas, feelings, or convictions about teaching machines and programmed instructional materials as obtained from statements made by faculty members in personal interviews or in response to printed questionnaires.

over 200 school systems now using programed materials. What has been the result? As teaching machines and programs have been introduced in schools in ever-increasing numbers, educators and psychologists have become concerned about how programed instruction can be effectively used under actual classroom conditions. Their concern is reflected in such practical questions as the following: What is the role of the teacher? How can programed instruction be successfully integrated in the overall educational program? Can programed instructional materials be effectively used at home as well as in school? Do we need a machine to present the programs? One of the most fundamental questions involves faculty attitudes toward this method of instruction.

Whether teachers in a school system, or faculty members in a medical or dental school effectively use programed instruction depends upon many factors, not the least of which is their attitude toward the value of the method for improving their present procedures. Although there have been comparatively few reports specifically concerned with teachers' reactions to teaching machines and programed instruction in the research literature, there is some evidence that the faculty attitude variable will be a very strong factor in the successful introduction and use of programed instruction in school and academic situations. In a preliminary report of a major field study type of research effort involving programed textbook mathematics programs, it was found that programed material without the teacher was superior to programmed material taught by a teacher with a basically negative attitude (Calvin, 1961). The report makes the assumption that "a teacher with an unfavorable attitude not only does not add anything, but actually is a marked negative factor".

It was the purpose of this study to determine teachers' and administrators' attitudes toward teaching machines and programmed instructional materials after operational classroom experience with a commercial teaching machine and a series of experimental spelling programs.

Method

Subjects

The student group consisted of 401 children from 12 fifth and sixth grade classes in 4 randomly selected elementary schools of the Los Angeles City School District.

Eight of the participating teachers were female and four were male. The average level of professional training among the teachers was a B. S. degree (eight teachers), with two teachers holding a M. A. degree, and the remaining two reporting the completion of the M. A. and thirty additional semester hours of course work. The average total number of years of teaching experience was 10.4 years, with an average of 5.4 years of experience in the Los Angeles City School District.

Four building principals and two vice-principals participated in the experiment. All the administrators were male and the average reported years of experience as an administrator were 3.5 years. All the principals had attained the M. A. level of training.

Teaching Machines

Simple recall teaching machines were used to present the spelling programs. The machines were mechanical and were approximately the size of a portable typewriter. Questions were presented in one window and the student wrote his response on a separate answer paper

in another window. The student then advanced the program, compared his response with the correct answer by actuating a lever, scored his answer, and moved the program on to the next answer.

Spelling Programs

A series of five fixed-sequence spelling programs were used to present eighty-six criterion spelling words during a four-week training period. The programs were part of a series of twenty-two programs which were originally prepared and used experimentally by Porter during the 1957-1958 school year at Harvard (Porter, 1959). The programs were modified to permit their re-use by students during the experiment and covered the same spelling words, reading vocabulary, and difficulty level as a conventional set of published sixth grade spelling materials.

Procedure

Twenty-one teaching machines were located in a special classroom in each of the four experimental schools. Each class was divided into two groups, with approximately twenty students in a group. The class came to a special teaching machine room every day at a scheduled time and remained one hour. Each group was assigned thirty minutes of training time, of which twenty minutes were permitted for actual working time. One group used the machines while the other group participated in some other previously assigned learning activity, either independently, or under teacher direction. At the end of thirty minutes, the teacher directed the two groups to exchange places, and the procedure was repeated for another thirty minutes.

During the experiment, no other formal spelling instruction was given in school, and no homework in spelling was permitted. While using the machines, students were not given any instructional assistance and they were directed to proceed on their own, except when mechanical difficulties were experienced in the operation of the teaching machines or in loading and unloading of the spelling programs.

Students recorded their own training time, program errors, and progress each day on prescribed record forms which were kept in individual folders. These records were verified by the teachers in order to ensure accuracy.

Attitude measurement was accomplished by means of self-constructed questionnaires which were completed by the teachers and administrators following the administration of the spelling criterion post-test. The questionnaires consisted of a total of seventy-eight multiple-choice and essay-type questions. There were intended to elicit attitudes, opinions, and reactions to a variety of topics related to teaching machines and programmed instruction in spelling, and to the use of this method for instructional purposes in general. After tabulation and analysis of the questionnaires, structured interviews were conducted with each of the teachers and administrators.

Results

Achievement

Student achievement results, as measured by criterion spelling tests, are beyond the scope of this paper. However, because of the obvious influence of student performance upon faculty attitudes toward programmed instruction, the most important achievement results are reported.

The experimental group of 401 students achieved a mean spelling gain of seventeen words, which represented a 19.5 per cent rate of gain. The range of achievement on mean gain in the twelve classes was from thirteen to twenty words. The mean total time required by the students to complete the five spelling programs was nine days and seven minutes. (An estimate of the time required to teach the eighty-six spelling words by conventional methods was approximately twenty days.)

There was no significant relationship found between spelling gain and the subject variables of sex, age, grade, reading comprehension, or intelligence.

Attitudes

There was no evidence of faculty resistance to current developments in programed instruction, although there was some expressed resentment over "premature introduction of poorly designed and unreliable teaching machines into schools in an attempt to exploit the anticipated market".

The majority of the faculty members indicated that programed instructional developments are proceeding at a slower pace than desirable and expressed highly favorable attitudes toward the potential of this method of instruction for operational use in the elementary school.

Six of the twelve teachers expressed negative attitudes toward the use of programed instructional methods for spelling instruction; five preferred to use machines and programs, and one teacher was undecided. The principals were evenly divided, with three favoring conventional methods and three expressing a preference for programed methods.

The majority of the teachers' and principals' attitudes toward the programmed spelling materials and the particular teaching machine used in the experiment were essentially negative.

There was common agreement among both the teachers and principals that negative attitudes toward the machines were caused by machine unreliability and maintenance requirements, noise characteristics, and classroom space requirements. The principal objection to the experimental spelling programs by both teachers and principals was that one spelling program was not sufficient for the wide range of spelling ability which existed among the students in their classes. Negative attitudes were directed at the programing logic of the fixed-sequence items in the programs for the teaching of spelling.

There was unanimous agreement among both the teachers and principals that the development of curriculum programs is more critical to the successful use of programmed instruction in schools than the design and development of teaching machines.

Teachers and principals listed the following potential advantages of programmed instruction for improvement of the instructional program in the elementary school: (1) individualization of instruction, (2) opportunity for teacher creativity in the learning process, and (3) quality programs and standardized instructional presentation to students.

The disadvantages of programmed instruction, as represented by this experiment, were suggested by teachers and principals as follows: (1) high cost of machines in view of budget limitations and requirements for other school and instructional equipment, (2) machine storage problems, (3) excessive maintenance requirements, (4) noise characteristics of machine operation, and (5) lack of

adequate provision for individual differences in the program content of the experimental spelling programs.

Teachers and principals were in agreement that programmed instruction, because of its provision for individualized learning, offers a better potential for improvement of the overall school program than any of the other media now in use in schools.

Discussion

The results of this study suggest guidelines for educators who are interested in applications of programmed instructional techniques in medical and dental academic settings. Caution should be observed, however, since it would be unwise to generalize from this spelling experiment to other curriculum areas and student age groups since the results were obtained from the use of experimental programs, one type of teaching machine, and a small faculty population. It is quite possible that the selection of the particular machine, the style of programing, and the method in which the programs and machines were employed during the experiment affected the results. However, it is believed that certain inferences can be safely drawn from the results of this study.

The questionnaire and interview data indicate that the attitudes of the teachers and administrators were essentially negative toward spelling instruction by programmed methods. Apparently faculty members were not sufficiently impressed with the effectiveness of such methods for teaching spelling since the majority of the staff preferred their own methods. Faculty members reacted in a negative manner principally because of mechanical difficulties with the machines, perceived limitations in the spelling programs, and insufficient evidence of more effective instruction by programmed methods as compared with their own instructional practices.

Because of student requests for assistance in operating the machines, six of the twelve teachers reported that they spent fifty per cent or more of their time with the students who were using machines and were thus unable to work with the other student group. This is a significant finding since it does not support the currently publicized notion that the use of teaching machines enables the teacher to make better use of his time, such as working with other groups of learners. This, of course, may eventually prove to be an advantage of using teaching machines, but there was no evidence found in this study to support such a conclusion.

Several implications seem to arise from these results. First, it seems clear that educators should view the results of laboratory investigations with some degree of caution. These studies frequently use small samples of students. In these settings, important considerations are sometimes not uncovered or reported. In this experiment, for example, the teaching machines did not function well under operational conditions. When subjected to hard wear by large numbers of students, the machines were unreliable and required an unreasonable amount of maintenance in order to keep them running. The mechanical difficulties apparently affected faculty attitudes in a negative way, and may even have impeded learning since the students were frequently interrupted by mechanical problems in the middle of a learning sequence. When twenty machines were used at a time, the resulting noise was distracting to the non-machine learners in another part of the room.

Second, regarding applications of programmed instruction in medical and dental settings, the results of this experiment raise the question of whether teaching machines should be considered for

use in presenting programs or should alternative methods be selected. It would be unfair to generalize from this experiment that all teaching machines are unreliable. Better designed machines, which are less noisy, more dependable, and easier to maintain may now exist, or be under development. The comparative merit of machine and non-machine presentation of programs is as yet an unresolved issue and is beyond the scope of this paper since there are many factors other than possible mechanical difficulties with machines which need to be considered in making this decision. Among these are comparative costs and learning results, space requirements, and characteristics of the programs themselves. For example, some subject matter will require machine presentation because of the need to provide audio as well as visual material. Another factor to be considered is the assessment of the number and quality of programs which are available for use in the machine which is being considered.

However, if the decision is made to use machines, the results of this study suggest that medical and dental educators exercise caution and discrimination, since the selection of an unreliable teaching machine could jeopardize the success of the instructional program, especially in terms of negative attitudes on the part of faculty members. Educators would be prudent in asking manufacturers for field test data concerning teaching machine reliability, operational noise characteristics, and maintenance requirements before purchasing and using machines in schools or universities.

A third implication is that the attitudinal data reported in this study suggest the importance and need for additional research involving faculty attitudes if teaching machines and programmed instruction are to be successfully introduced and used in school and

university settings. Based upon the history of other innovations in the classroom, teacher acceptance of a new audio-visual aid or teaching method is largely dependent upon their attitudes. Teachers who feel positive toward the value of programmed instruction will probably use the method extensively and derive maximum benefits from the experience. On the other hand, if teachers feel uncomfortable with teaching machines in the room because they make too much noise, or break down, their attitudes will tend to be negative and the machines will probably not be used very frequently. Even today, motion picture projectors, tape recorders, and other worthwhile audio-visual aids are apparently not being used in an optimal manner in schools and universities. Teachers seem to fear the mechanical characteristics of these devices, and claim that they are difficult to use without considerable teacher inconvenience. The result is minimal utilization of these instructional aids.

The implications of negative faculty attitudes seem quite clear. Unfortunate initial experiences with unreliable machines and inadequate programs could serve to seriously hinder the entire automated teaching movement.

Finally, teacher acceptance is also closely related to the degree of teacher involvement in the introduction and use of instructional innovations in the classroom. In large measure, it seems reasonable that the potential of programmed instruction in medical and dental school settings will be most quickly and effectively realized to the extent that faculty members become personally and actively involved in the development process. If the method is imposed by means of administrative edict, then teacher resentment, lack of understanding, or disinterest could serve to negate the

results. However, if instructors are brought into the planning and development process; if they are encouraged to make contributions, perhaps in terms of determining the ways in which programmed methods are used in the classroom, they will strive to accomplish worthwhile results. Experimental tryouts in university or school settings, of both locally and commercially developed programs are to be strongly encouraged.

Training faculty members in the knowledge and use of programmed materials could prove to be one of the most important objectives of a medical or dental school's staff in-service training program during the next few years.

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THE BOARD OF NATIONAL TELEVISION

Michael C. Rogers, P.D.

President and Chairman

Department of Special Investigation

Department of Information

College of Business

University of Maryland

Approved:

Today I, of the Board of National Television, have the honor to inform you of the results of my investigation into the matter of the alleged violation of the National Television Act of 1937, as amended, by the National Television Company, Inc., and its subsidiary, the National Television Service, Inc., in the operation of their television stations in the State of Maryland.

Enclosed for you are two copies of a report of my investigation, which is being submitted to the Board of National Television for its consideration and action thereon.

Section II

CLOSED CIRCUIT TELEVISION

§

The Board of National Television has the honor to inform you that it has received a report from the National Television Company, Inc., and its subsidiary, the National Television Service, Inc., regarding the alleged violation of the National Television Act of 1937, as amended, by the National Television Company, Inc., and its subsidiary, the National Television Service, Inc., in the operation of their television stations in the State of Maryland.

As you have been advised, the Board of National Television has the honor to inform you that it has received a report from the National Television Company, Inc., and its subsidiary, the National Television Service, Inc., regarding the alleged violation of the National Television Act of 1937, as amended, by the National Television Company, Inc., and its subsidiary, the National Television Service, Inc., in the operation of their television stations in the State of Maryland.

ONE DECADE OF DENTAL TELEVISION

by

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Coordinator of Television
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University of Kentucky

Abstract

Today 31 of the 48 dental schools in the United States employ television to varying degrees, as a visual aid which allows an entire dental class the instantaneous observation of the inside of a cavity preparation greatly magnified.

Student participation can be employed. An element of drama is introduced in an exodontia lecture when a senior student is asked to come forth and extract a tooth before his colleagues.

Not content to reign supreme in the living room, this obtrusive electronic giant is now besieging the sacred walls of the classroom.

For nearly two decades the American home has been virtually dominated by an electronic giant. We have earned the distinction of being the only nation in the world where more homes have television sets than have bath tubs. Whether or not this represents a milestone of human progress, history alone will record. But what of the contemporary appraisal of this newest of the mass media?

We've heard television hailed as the marvel of the 20th century, a veritable boon to mankind. We've also heard it damned as a bane to our existence, the moronoscope, the boob tube. There are those who say it is a medium because it is seldom rare or well done.

However, this much we must acknowledge. A medium which has the potential of simultaneously and instantaneously communicating with every human on the face of our planet must have a profound influence on the course of civilization. Not content to reign supreme in the living room, this obtrusive electronic giant is now besieging the sacred walls of the classroom. With traditional awareness of his responsibility, the educator has not been readily seduced by the promises of this new educational medium, but instead has proceeded with deliberate caution. Although daily we hear encouraging reports of progress in the academic applications of television, it is significant and to the credit of educators that this progress has not been characterized by any decrease in the importance of the teacher, but instead, by a marked increase in his potency. The giant has been harnessed to serve as an arm to education, rather than its brain.

The very essence of education is communication. Television is considered the master medium of communication. Hence, its unique value as an educational tool.

A person learns largely from his five senses, sight, hearing, smell, touch and taste. It has been estimated that sight and sound account for 95% of all learning stimulants. Television transcends time and space by being an instantaneous conveyer of image and sound, and let us note that this image may be multiplied, magnified, compressed, stored, or even modified electronically to suit the needs of the particular situation. We've been amazed by Polaroid 10-second still photography. Video tape is instantaneous motion picture photography and with sound.

It is now ten years since closed circuit television has been used in dental education. Loyola University of Chicago and the

University of Detroit first started using television for undergraduate teaching in 1953. By 1959, six dental schools had television installations, and today, 31 of the 48 United States dental schools employ television to varying degrees and have invested \$750,000 in the necessary hardware. This significant increase in its use suggests wide acceptance of television in dental education. Yet, it is interesting to note that until December of 1961, no United States dental school had published any data evaluating the medium specifically as applied to dentistry. Is it possible that its value is obvious to a degree that evaluation seems unnecessary?

A brief analysis of dental educational objectives may be useful. The would-be dentist must acquire knowledge, skill and attitude. Knowledge of the total human organism in health, as well as disease. Knowledge of the scientific and biologic basis for the many procedures necessary to prevent, diagnose, control and treat oral disease and disorders. Knowledge of instruments and instrumentation necessary to these procedures. The skill to perform these intricate procedures on hard as well as soft tissue, in most instances within the oral cavity, usually within the confines of an individual tooth. The skill to perform certain extra clinical technical procedures necessary in support of treatment; the skill necessary to manage a distressed human organism, and have them submit to treatment rendered in most instances in a conscious state. And finally, the attitude necessary to adequately assume and discharge a serious responsibility.

The very essence of a great part of this teaching and learning process is intimate observation. This observation is in a field ranging in size from the inside of a tooth pulp chamber to the inside of a dental operatory or consultation room. Where it is possible

and practical for a student to be at the elbow of his teacher, observation is, of course, not a problem. On the other hand, where as in most instances, circumstances do not allow this intimate ratio of student to teacher, observation becomes a serious obstacle. Television has proved to be a visual aid which allows the instantaneous and simultaneous observation of virtually any size field by any size group. Television is an expedient device which allows the dental educator to take his entire class at one time where it could never be, such as the inside of a cavity preparation, and where it should never be, such as the inside of a consultation room. And all of this it accomplishes with relative ease and economy.

For the past 20 months I have been conducting a survey of the use of television in dental education for the United States Office of Education. Shortly, this report will be available as a government publication. The survey, for the most part, consisted of a sight visit by this investigator to 18 of the 31 dental schools using television, and a survey conducted by local assistant investigators in the remaining schools. Although it is not the objective of this paper to preempt the forthcoming publication, it does seem appropriate to list certain general analyses from this survey.

First, television's major application to date in dental education is its use as an image magnifier and/or multiplier. It has been found valuable in enhancing and facilitating the dental demonstration.

Two, we are still in a developmental stage, and although significant progress in its application has been made by some, not all schools possessing installations are utilizing television to the same degree.

Three, results have ranged from dismal disappointing failures to exciting successes.

Four, there is a serious need to disseminate the basic knowledge, meager as it may be, in the field.

Five, the cost of installations ranges from \$3000 to \$125,000, and there seems to be no correlation between cost and amount of use.

Six, it has not replaced the use of other visual aids, such as motion pictures and slides.

Seven, in some instances, initial enthusiasm for the medium has waned. It does not seem appropriate for me to express my opinions at this time as to the reasons that this has occurred.

Eight, television as yet has not been responsible for any basic changes in traditional dental pedagogic techniques, other than to facilitate the demonstration.

Nine and finally, it appears that television as a tool in dental education is here to stay.

In addition, of course, to its intramural use in the dental schools, we have become accustomed to having television presentations enhance our dental meetings and conventions almost routinely. In order for a discussion of the past ten years of dental television to be complete, it seems necessary to mention the occurrence of April 26, 1961. On that date 36,000 dentists in 51 cities throughout the North American Continent sat down at one time and viewed the first mass attempt at post graduate dental education. Television Dental clinics, as it was called, was a commercially sponsored one hour and a half telecast, which emanated live from the University of Pennsylvania School of Dentistry and the University of Southern California School of Dentistry. Together with Drs. Ingraham, Tanner and Eidson, I was privileged to participate in this event.

In a sense, the participants of this telecast helped somewhat

like the people who dropped the first atomic bomb on Japan. One single bomb delivered more explosives than all the previous bombs exploded in two World Wars. Just as one telecast delivered more actual man hours of post graduate dental education than had probably been delivered in the entire history of both schools. I would like to predict at this time that television's greatest value to our profession will prove to be its use in the continuing education of the dentist. It can be noted that our colleagues in medicine have already made great strides in this direction.

Recently we have completed a television facility at the new College of Dentistry at the University of Kentucky. Most of you, I'm sure, know that this is the nation's newest dental school, having started its first class this year. Since I previously participated in the design and installation of the television facilities at the University of Pennsylvania in 1956, the installation at Kentucky represents a second attempt at interpreting how television should be used in dental education. In other words, we have had the luxury of a second guess with an intervening seven years of experience in the use of television.

When we first considered television in 1956, we were conditioned to thinkⁱⁿ terms of a studio. Consequently, we equipped a room to serve as our television studio and connected it with a lecture room on another floor, which was to serve as a reception area.

The television equipment in this studio cost \$8,000.00, and the reason it cost \$8,000.00 is that this was the entire amount we had to spend. It is important to note that we considered this an interim arrangement until we had additional funds to equip a more professional type studio. Actually, we now consider it fortunate that we

were forced to start in a simple manner, insofar as this simple approach required a lesser degree of technical competence.

Our lecture room reception area was equipped with four wall-mounted 21" monitors. There was also a two-way audio communication with the remote studio. Even our early attempts elicited a considerable degree of enthusiasm from both faculty and students. We realized that television was a visual aid par excellence for enhancing and facilitating the demonstration of dental procedures. In a very short time all departments converted in person demonstrations to televised demonstrations.

After about six months of using television, scheduling problems arose concerning the use of our T.V. lecture-reception room, since this room was also used for non-television teaching. Therefore, in order to use television for a post graduate course, it was decided, as a measure of expediency, to seat the class of 25 in our television studio.

This meant that the class, the teacher, the patient, the T.V. camera, and the monitor were all in the same room. Immediately it became apparent that this approach had decided advantages over the remote origination and reception point approach.

As a result of this experience at the University of Pennsylvania, we designed a lecture room at the new University of Kentucky College of Dentistry which allows both remote and "in person" types of television demonstrations. This was accomplished by building a television origination area adjacent to a lecture room and connecting the two areas by means of a folding door wall. In a sense, this means that this lecture room is equipped with a visual public address system, consisting of simple television equipment capable of being operated with little training by student assistants or even faculty.

This approach offers a relatively simple way of augmenting any lecture with "live" visual material. As a result of this type of facility, a new teaching-learning experience can be created whereby a high degree of student participation can be employed. An element of high drama is introduced in an exodontia lecture when a senior student is asked to come forth from his seat and extract a tooth before his colleagues!

We have passed through what might be termed the "adaptation phase" of dental television. Now that there appears to be virtually universal agreement that it is an extremely valuable visual aid in dental education, we are prepared for the second phase. This should be termed the "adaptation phase", or that phase where television is modified to suit the needs of dental education.

The technological age is confronting academic institutions with challenges and opportunities of unprecedented magnitude and scope. It becomes the responsibility of all educators to utilize any new aid, technique or tool, which may help us meet this challenge and take advantage of these opportunities. Television has emerged as an exceedingly versatile servant of education. It is my feeling that its effectiveness is limited only by the amount of effort, imagination, and judgment expended.

SIMULATION AND MONITORING DURING SPACE
CONFINEMENT STUDIES

by

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Abstract

One of the most productive techniques available to the life scientist is the simulation and monitoring of crew physiological status and performance during varying periods of crew confinement within selected cabin configurations. Realistic data may be generated and verified in relation to mission duration times, and anticipated tasks and levels of task performance.

Three confinement studies with supporting data are discussed. Closed circuit television has proven beneficial as a means for continuous surveillance of subject status and performance on a non-interference basis.

Currently, increased emphasis is being placed upon the utilization of simulation and monitoring techniques as an extremely useful tool for research, planning, design development and test associated with the development of complex manned space systems. Such emphasis is necessary due to the exacting and unique operational requirements of manned space system missions, the high cost of system development and the stringent requirement for anticipating operation "Environments" prior to their occurrence.

To the Life Scientist specializing in manned space system development programs, simulation and monitoring techniques have been particularly effective as a means for specification, development and test of biomedical requirements and life support design criteria. In addition, simulation techniques have been used with high success to establish and validate space crew personnel task performances as well as to provide the basis for spacecraft interior arrangement and design equipment and procedures compatible with using personnel.

One of the most productive techniques available to the life scientist is the simulation and monitoring of crew physiological status and performance during varying periods of crew confinement within selected cabin configurations. Through utilization of these methods, realistic data pertinent to crew physiological and psychological well being may be generated and verified in relation to proposed cabin configurations, intended mission duration times, and the anticipated tasks and levels of task performance required of the crew. Results of space cabin simulation studies may serve as direct input to system design engineering, for system planning, or serve as the basis for further Life Sciences research and study. With the advent of prolonged manned orbital and manned interplanetary missions requiring extended periods of habitation in space, simulation studies will play an even more important role in Life Sciences efforts.

This paper is devoted to a brief discussion of space cabin simulation and monitoring techniques as used in industry by Life Sciences specialists to study physiological and psychological factors related to three specific space system missions and crew cabin configurations. Simulation techniques employed in the three cabin studies are briefly discussed in terms of duplication of anticipated cabin configurations

and operating conditions including psychological representation of anticipated "real mission" crew tasks. The importance of closed circuit television as a method for assessment and monitoring of cabin habitability and functionality, crew status and performance is discussed. Lastly some results of the space cabin simulation research studies of interest to biomedical specialists are presented.

Three confinement studies in simulated space cabins, all of different configurations, serve as the basis for this report. These studies were conducted at North American Aviation, Inc., Space and Information Systems Division, Downey, California, over the past two years.

From a biomedical standpoint, there were two major purposes for conducting these studies. The first was to evaluate the habitability features of the cabin designs from a physiological viewpoint. The second was to obtain baseline physiological data for a variety of space vehicles. It was the hypothesis of the investigators that a cabin allowing a large living area and other habitability features would reflect little if any physiological differences from a normal life situation with a relatively sedentary occupation such as that of an office worker. On the contrary, life in very small cabins would reflect drastically reduced levels of metabolism and cardiovascular response almost commensurate with bedrest situations.

Basic structures for each of the three cabin simulation studies were wooden mockups of a particular vehicle cabin configuration. The first cabin study used a mock-up of a small conical-shaped cabin with an exterior volume of about 450 cu. ft., providing a living volume (volume for human occupancy) of 200 cu. ft., and a living space of 39 sq. ft.

Three men were confined therein for a period of seven days. This cabin is designated Cabin A. Another study involved a space cabin mock-up with a cylindrical configuration, Cabin B, which had external volume of about 3500 cu. ft., an interior living volume of approximately 1500 cu. ft., and living space of about 150 sq. ft. Four subjects were confined in this study for seven days. Cabin C, the third cabin studied, was disc-like in configuration, with an external volume of approximately 3200 cu. ft., an interior living volume of about 1600 cu. ft., and a living space of about 400 sq. ft. Two men were confined in this mock-up for a period of four days. Thus, the various mock-ups provided the following living space per man: Cabin A, 13 sq. ft.; Cabin B, 37 sq. ft.; and Cabin C, 200 sq. ft. In all three studies, the subjects were confined continuously for the period indicated, without any outside contact except via intercom at programmed intervals. In each study, a simulated space mission with a scheduled work-rest regimen was carried out. All requirements for eating, sleeping, personal hygiene, and investigative procedures were provided on board. Although the mission profiles differed, the biomedical and physiological aspects of each were similar, and comparisons can be made. Control stations where psychological and physiological investigations continuously monitored each simulation were located immediately adjacent to the mock-up.

Within each of the three cabin configurations, the location, physical features and size of control panels, operator work station arrangement and cabin equipments were extended to approximate "real mission" cabin configurations.

Physiological and psychological tests utilized within each of the cabin simulation studies were chosen to yield an extended spectrum

of data and simplicity of administration compatible with intensive physiological, personality and behavioral sampling. Physiological testing procedures ranged from simple techniques such as taking oral temperatures to highly instrumented psychophysiological tests. Psychological tests covered a continuum from easily observed manual behavior, e.g., Purdue Pegboard, to relatively unobservable emotional reactions, e.g., the manifest Anxiety Subtests. Where possible, psychological tests were derived from tasks deemed similar to real mission crew performance tasks and physiological measures derived from physiological tests which would be required during a "real mission". Both physiological and psychological testing was accomplished in accordance with the work-rest-sleep cycle representative of the real mission.

One of the prime assets of space cabin simulation research is the ability to study human physiological status and performance under selected and controlled environmental conditions with minimum hazard to the subject. In this regard, closed circuit television was an essential part of each of the three simulator studies. Primarily the utilization of closed circuit television enabled continuous surveillance of subjects so that research personnel would have continuous visual evidence of the subject's condition and behavior. In addition, closed circuit television provided for Kinescope recording of events for later re-assessment in combination with recorded measurements and communications.

Closed circuit television also provides an excellent means of presenting stimulus materials to the simulation subjects for performance testing. As the result of actual space missions, closed circuit television may be used during non-performance periods to

increase fidelity of simulation by presenting actual pictorial views as they will be seen by the space crew.

The use of closed circuit television may best be stated by a description of the utilization of the monitoring technique in Cabin B, the cylindrical capsule.

Seven Vidicon Cameras and five monitors were used in this study to provide continuous surveillance of subjects, to present stimulus and response materials for three performance measures, and to increase simulator fidelity by presenting pictorial views taken during actual space flight.

The continuous surveillance of subjects was carried out by cameras 1, 2, and 3 mounted at strategic locations within the simulator and two TV monitors at the control center. One monitor viewed the control console in the simulator at all times. The other monitor was on a dual control so that either the right or left portion of the general living area of the simulator could be monitored as desired. The cameras were in a fixed location and were controlled from outside the simulator. Although the subjects were aware of this continuous surveillance capability, they made no directed effort to obstruct the camera view. However, at times they would sit or lounge in an area where only a shoulder, elbow, or top of the head could be viewed.

Cameras 4 and 5 were used to transmit written messages. Both of these cameras were connected through the control center so that stimulus materials could be monitored. Camera 4 was mounted in a light-tight box in an "on" position. Stimulus materials were printed on a 5 x 8 card which was inserted into a viewing position slot, a flip switch turned on a light of sufficient intensity to enable the camera to transmit the picture of the 5 x 8 card to the monitors.

Camera 5 mounted in a similar device within the simulator enabled subjects to transmit written responses to the researchers. This system served the dual purpose of back up to the intercommunication system.

Camera 6 was used in a target detection task. A viewer was constructed of poster board with coordinates indicated. Stimulus materials, inserted in the viewer, were picked up by Camera 6 and presented to the subjects on the monitor at the simulator console. Subjects were allowed to adjust brightness and contrast on the monitor which added to the fidelity of the task.

Camera 7 presented continuous visual environment simulation. Films of the earth taken during a recent Mercury shot were edited to present orbital orientation with blocked out portions to simulate night-day relationships. The films were presented continuously throughout the mission and could be viewed at any time on the monitor at the simulator console and on the monitor at the control center.

Cameras 1, 2, and 3, used for continuous surveillance of the subject, were controlled from the control center. Camera 5 in the written message device located in the simulator was controlled by the subjects. Cameras 4, 6, and 7, for presenting stimulus materials and environmental simulation were controlled by the control center.

While subjects could adjust the brightness and contrast of the monitor within the simulator, the type of subject material was controlled by the researcher. Therefore, with the closed circuit television system it is possible to achieve a higher level of control over visual inputs than with other inputs such as audio. Secondly, the use of closed circuit television eliminates the need for direct viewing and thus enhances the simulation of remoteness.

Physiological and psychological data resulting from the three space cabin simulation studies are lengthy and detailed. For purposes of this paper, only those biomedical data are reported where significant change occurred or where particular interest lay. All simulation subjects were in good health and the post-confinement physical examination revealed that no pathological change occurred during the studies.

Nutrition and Activity

In all studies a mild starvation occurred even though food was allowed ad libitum, which finding is consistent with most studies of this nature. It appears that subjects frequently lose the ability to judge their metabolic needs in such an artificial situation, and programed feeding may therefore be necessary.

Comparing the values for the 70-Kg man in each study it is seen that the energy needs varied considerably. Since the amount of activity determines the energy requirements, it is apparent that activity levels within these cabins might vary markedly, even though the mission tasks are similar. In Cabin A where movement, and consequently, activity was reduced to a minimum, the energy needs were almost those of the bedrest state. In Cabin B, because room size space was available for movement, activity increased accordingly, but the activity was still on the lower limits characteristic of a sedentary occupation. Cabin C, on the other hand, with a large amount of free space, allowed activity levels well within those of the average office worker.

Water

Water needs for these space cabin environments is considerably below the normal requirements of 2.5 to 3.0 liters per day, except in

Cabin B, where slightly higher thermal conditions existed. In Cabin A the subjects became dehydrated, a finding frequently noted during stressful situations. Cabin B and Cabin C reflect the activity level and thermal conditions. The Cabin C subjects overhydrated themselves which may be a reflection of the "plush" conditions that prevailed therein.

Physiology

The vital signs in Cabins B and C remained fairly constant throughout the study. There was no significant change in pulse rate or in blood pressure--either systolic or diastolic. These findings are consistent with the general level of activity. The subjects in Cabin B also engaged in some light exercise to offset the effects of their reduced activity. By contrasting the data for Cabins B and C to that of Cabin A, where the vital signs showed a significant decrease almost to that of a prolonged bedrest level as might be expected in a cabin where space limitations are so drastic, it is obvious that for prolonged space missions, programed exercise will be essential.

Blood studies for all simulations were within normal limits.

Urinalyses revealed that all the subjects in Cabin A and two of the subjects in Cabin B had developed traces of acetone as the simulations progressed.

The analysis of the urine for 24-hour 17-KGS is a valuable measure of stress response and has not often been reported for space cabin simulations. The marked rise for two of the subjects in Cabin A, and two of the subjects in Cabin B at day 3 and 4, and for both in Cabin C on day 3, is a finding observed in other cabin simulations and is probably attributable to the stress of confinement itself--a

motivational "change of heart". The initial motivation for such a study is probably wearing off at about this time and the subject realizes that the confinement will continue. This response usually decreases by the next day and in more prolonged confinements.

Confinement within these various cabin configurations produced no evidence of physiological impairment, however, changes similar to those of a bedrest state were noted in the very small cabin.

The general activity level of the crew as measured by mean caloric expenditure is related to the living space per man provided by the cabin. The energy expended in the very small cabin was near the bedrest activity level while that in the very large cabin was in the light office work range. On this basis an area of about 90 sq. ft per man for space cabin simulation or 700 cu. ft. per man for actual space cabin conditions would be optimum for long durations.

Programed food and water intake is essential to assure that proper nutritional status is maintained.

Cabin simulations do produce physiological evidence of emotional stress as measured by urine analysis for 17-Ketogenic steroids.

In addition to the specific results obtained during the space cabin studies, it is believed that the study efforts have proven the value of simulation and monitoring techniques for life science applications in manned space system development. Closed circuit television has proven beneficial as a means for continuous surveillance of subject status and performance on a non-interference basis. In addition it provides a means for Kinescope recording of events of particular interest and/or importance for later playback and analysis as a supplement to other measurement techniques. The value of closed circuit television for communication of task stimulus information and increased fidelity of simulation also provides considerable additional benefit for simulation research efforts.

EVALUATION OF CCTV UTILIZATION
IN TEACHING DENTAL TECHNIQUES

A Preliminary Report

by

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Dr. Arthur H. Morrison of New York University presented a preliminary report of an experimental study of the use of closed circuit television in the teaching of dental techniques. This study was made possible by a grant from the Department of Health, Education and Welfare under Title VII of the National Defense Education Act. The planning of the experimental design and gathering of data were done by Mr. Leon Bloom whose doctoral dissertation will report the study in complete detail. Dr. Morrison described several interesting highlights of the experimental procedures and reported several illustrative examples of the obtained data.

Section III

AUDIO-VISUAL PERFORMANCE AIDS

THE USE OF INDUSTRIAL AUDIO-VISUAL TRAINING AND
PERFORMANCE AIDS IN MEDICAL AND DENTAL EDUCATION

by

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Abstract

Rapid changes in industrial training are taking place to meet increased product reliability demands and increased complexity of job performance. Traditional principles of learning, and the techniques of task analysis are being applied to self-instructional, audio-visual devices for skill training and job performance. The procedures involved in developing audio-visual programs are discussed and related to potential medical-dental application. In addition, a pioneer study conducted at the University of Southern California School of Dentistry is reported and discussed.

Introduction

Fundamental changes in education--especially in dental and medical education--do not occur rapidly. However, changes in industrial training, where materialistic values prompt sterner judgement, occur rapidly. In the electronics and aerospace industries, demands for stringent and unique training have seriously challenged the effectiveness of conventional methodology. Increasingly complex information which must be transmitted from research and development personnel

to hardware production people, as well as the increase in demands for product reliability, are stimuli for the changes.

Stimuli for improvement in the methods of teaching dentistry and medicine also exist. For example, approximately 3000 new dentists are graduated annually. However, about 2000 die every year leaving the country with a net gain of only 1000 dentists per year to care for an annual population increase of some three million. A similar problem exists in the medical field.

In order to properly serve the expanding population, there must be an increase in the number of medical and dental doctors. In the light of a limited number of qualified medical-dental instructors, some fundamental changes in training procedures must be evolved if more doctors are to be trained. Some of the changes occurring in industrial training and job performance may well be applicable in doctor training programs.

Industrial Training

Industrial training, like any training, may be categorized into three basic areas:

1. Informational or concept training: this training mode is involved with the learning of principles, theories, methods, and concepts.
2. Motivational training: the purpose of this training mode is the shaping of attitude through creating an association between the trainee's basic needs and the behavior he is expected to adopt.
3. Skill or procedural training: this training mode involves the learning of psychomotor coordination and/or detailed, procedural, manual functions.

Improvements in training methods for each of the above areas are occurring in industry through effective utilization of programmed learning, teaching machines, closed-circuit television, and audio-visual (A-V) performance aids. The latter media, A-V aids, will be discussed in detail, and related to healing arts procedural training.

Industrial Procedural Training and Performance

Procedural training and performance involves (1) learning specific procedures, and (2) execution of the learned procedures through job performance.

Production workers must perform a great number of critical operations. Historically, the procedures for these operations have been communicated to the worker through blueprints, schematics, sketches, and the like.

Workers go through training courses to learn how to read, interpret, and respond to various symbols. They also are taught welding, soldering, wiring, and many other requisite skills for executing specified instructions.

In the past, a few hours of classroom instruction, combined with on-the-job training, were sufficient to train production workers to perform relatively simple tasks in fabricating relatively uncomplicated, fairly reliable products. But today's products, especially for the military and for space exploration, have greatly increased in complexity.

At the same time, contractual demands have been imposed on the manufacturer to guarantee high levels of product reliability. As a result, conventional methods of training and job performance have had to be reevaluated. In fact, the military, as well as the National Aeronautical and Space Administration, now require their contractors

to specify training plans and the means for implementation.

The Need for New Methods

New methods of training and job performance are necessary to meet today's industrial requirements because of the following reasons

1. Standardization of training is demanded. Workers must be qualified and certified to perform with precision specified jobs in a prescribed manner. In order to accomplish this objective, programs must eliminate: (1) instructor differences, (2) variance in task interpretation, and (3) inherent differences in the quality of instruction from one training session to another. Conventional training methods will not satisfy these requirements.
2. A capability for rapid-changing assembly instruction is demanded. When a change order is initiated, it must be reflected in the training program as rapidly as possible. Conventional training methods invariably require long lead times.
3. Efficiency, in terms of job performance and costs, must be demonstrated. Conventional training methods, when compared with audio-visual systems, are ultimately far more costly; but more important than costs, conventional methods do not assure satisfactory levels of quality, whereas A-V aids do assure high quality.

Audio-Visual Aids for Job Performance

A more or less standard type of audio-visual unit has been adopted by industry for both training and job performance. This audio-visual unit is a box-like device, weighing approximately 20 pounds. The device's configuration permits it to be placed in a

convenient work position. Designed to be used by one person at a time, the unit houses an optical system that projects 35-mm color slides on a rear projection screen approximately 8 by 10 inches in size.

The unit also contains a miniature tape deck which plays standard one-quarter inch magnetic tape. The tape is contained in a cartridge for easy handling. When slides and tapes are inserted into the device, the tape audibly explains the material on the first slide. The tape may be stopped while the worker performs this task; it may be restarted for additional instructions. After restart, the tape may give additional instructions concerning the first picture, or--by means of an electronic tone--it can advance the next picture in the series and give instructions concerning the second picture. This procedure can be followed throughout the entire sequence.

These devices, when used as described, should not be labeled teaching machines. Although some of the techniques of teaching machine programming are utilized, the objective of terminal behavior is not necessarily the retention of information. Yet, the devices can easily be converted into true teaching machines by incorporating a respond mode, either oral, key, or written.

DENTISTRY TRAINING

Audio-Visual Devices Applied to Dentistry

A pilot study was made at the University of Southern California School of Dentistry in an attempt to apply some of the techniques of industrial audio-visual systems to dentistry procedural training. A specific unit of work--from a graduate course in Class V Gold Foil filling--was selected for programming.

Of eight dental graduate students involved, four participated in an experimental group and four were in the control group. The experimental group participants received their instruction exclusively from individual audio-visual devices. The control group participants were instructed through a conventional lecture. After receiving their respective instructions, both groups were requested to perform a laboratory demonstration of proficiency and quality in completing a Class V Gold Foil filling. Both groups were graded through established procedures. The professors who evaluated the work were unaware of group assignment.

Findings revealed that the grades earned by the experimental group were equal to those of the control group, with both groups scoring unusually well. The fact that the lecture was given by the audio-visual programmer is hypothesized as a bias in favor of the control group. Detailed depth interviews with the experimental subject revealed strong, positive attitudes toward this method of performance instruction.

In view of the critical need for medical and dental instructors to train students in an increasingly diversified curriculum, the potential inherent in self-instruction performance appears promising.

DEMONSTRATION OF INDUSTRIAL AUDIO-VISUAL TRAINING
AND PERFORMANCE AIDS IN MEDICAL AND DENTAL EDUCATION

by

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Abstract

The procedure used and the problems encountered in the fabrication of a 20-minute audio-visual program are enumerated in this paper. The necessity of using professional personnel to handle the various technical phases of producing a quality program is emphasized.

What I would like to do is to show you the manner in which a program of this nature is put together and describe some of the things that we ran into; some of the problems that occurred. These came to mind very vividly yesterday morning when Mr. Jones was talking and ribbing us a little when he said that if you have a problem, get a professional to solve it. If he has a dental problem he gets professional help. This is what we ran into and I'd like to describe some of these problems for you.

The actual programing has to start with the teacher. The teacher is the one that knows what he wants the student to know and in trying to record all of this he is the one that runs into the greatest number of problems and he has to call on professional help. But it starts with the teacher. He is the one that has to study and analyze what he wants the student to achieve. He must determine what the objective of the program is. One thing that we have

concluded from a number of years of teaching, particularly with the dental student, is that you can elevate him to any degree of skill that you want. All you have to do is to set your own level and he will produce to that level. If you want to set your level low, he'll produce a low result. If you want to set it high, he will come up to that level. One of the biggest problems in dental teaching is the time factor. In trying to expand our curriculum each department and each teacher in that department feels that his is the most important subject and to expand his phase he must usurp some of the time of the other departments. This cannot be done. So the time has to be found somewhere within his own program. One of the finest things that can occur as a result of programing your material is that this saves time for you. You can add whatever new material is needed and you can expand your curriculum to whatever degree of time you have saved as a result of your programing. The teacher has to set down what he wants to get across to the student and he has to put it down in a form that he feels will get across to the student. Now, the thing that comes rather bluntly to the clinical teacher's mind here is that when you are working with a student in a patient situation you all of a sudden become aware that the words you have used did not convey to the student the same thing that the words mean to you. This is a real good example of how you have to have another professional work with you. When Dr. Golden read over the original script on the class V foil, it didn't make sense to him in some of the parts and yet, to me, it made sense, but I was the one who was writing it. However, if it didn't make sense to Sandy, and he was the one who really counted, the verbage had to be changed. It had to be edited so that a student could get the same impression

from a word that the instructor was thinking of when he was using the word.

Well, we didn't get into the use of an expert on semantics but we did get into the problem of whether the verbage that I was using was adequate; did this convey the proper message to another dentist, a student or even someone not knowledgeable in dentistry? This intermediate problem was taken care of, in addition to his other duties, by the consulting psychologist, who was an expert in programming. We tried to develop our script to the point where it conveyed the message to someone not knowledgeable in the field. When we got to this point, we felt that it would be acceptable material for a student. Jim Crumpler was acting as the consultant on our programming. If we could get the message across to him, not being knowledgeable in dentistry, and he understood what was trying to be achieved, then we felt that the wordage was right.

But the main function of the consulting psychologist is to give the professional dentist the knowledge of programming and one of the first things that I found was that I was trying to get too much material into a given segment of a lesson. The thing that Jim pointed out to me was that I must keep diminishing this thing and put one little point in at a time, so that the student is led from one little point to the next little point, rather than trying to take the beginning and the end and make it in one big step. Another thing the programmer can point out to you is this: he can take a look at the material that you're trying to get across and tell you how much time should be allowed for this particular point. Some points that require mental gymnastics and also require the visual gymnastics of trying to decide what part of the picture to look at require more

time than if it is a simple little point and there's an arrow in the picture to immediately attract the attention of the student. Another thing that was of tremendous importance in this is that your programs must be short. The average span of attention is somewhere between 13 and 20 minutes and you cannot keep the student's attention for any appreciable amount of time past that limit because the amount of retention is going to be a lot less. These are the things that the professional programmer can point out to you. You can't bypass this step.

Once you have decided on the wordage of your script and you have decided on your sequence and you have decided on the time phase of it, then it must be recorded. Of course in this next phase you have to go into the sound room and here comes another professional. You have to have a man skilled in the production of these tapes. It's a bit more than just sitting down and making a simple tape recording. It means putting the audible and inaudible signals on tape as you heard on the little demonstration here. The audible one indicates that you must stop the slides and stop the tape at that point so that you can have time to do whatever was to be done for that particular step. And there is an inaudible signal that will change the slides for you, so this should be done by the professional.

Another thing this professional can point out to you is this: most of us talk too fast and this got me listening to commercials. It's amazing how slowly these fellows doing the commercials will talk. This instruction in talking allows the familiar voice of the teacher to be maintained in the program and may be of importance from the student's point of view in associating the subject material with the appropriate teacher. As you are developing your audio program you will develop your slides and these must be well done from

the artistic standpoint. The artist knows how to draw attention to a particular portion of the picture. He can bring things into a drawing that you could not actually see if you were looking at the object itself. These things may not be photographically accurate, but the intent is to emphasize specific features. So, the artist is another important part of the overall picture. In doing a 20-minute presentation, you might have 30 to 50 slides and you might have 200 hours of artistic time. Then, you add the professional teacher himself; you add the photographer; you add the technician for the recording; you add the programmer; you add your consultant for the wordage. This will add up to about 200 hours. In the overall production of this 20-minute procedure you will probably have around 400 hours invested.

Now, once you have your package all set up - you have your hardware, you have your slides, you have your script on tape, you must instruct the student in the use of the instrument. Once he has checked out on the instrument he can go through his program rather rapidly. In the experiment that we did, and this was with four post-graduate students using machines on a routine lecture, the material in the machine took a little less than 20 minutes, and yet it took me, lecturing on the same material, an hour and a half. So, the students that were with the machines were able to go through the program three times while the students that were listening to my lecture had to sit there and just listen to it once. The important point here is that on tape you don't waste words, but standing up here on a podium and lecturing to somebody you're inclined to get off into fields that are not really well related to the subject material. There are certain things from the formal lecture you cannot put on

these programs, at least I don't feel that you can. For instance, I don't think that in programing a procedure you can talk philosophy and certainly in bringing these young minds along you have to develop a philosophical outlook for them. You have to give them something to strive for. You have to give them some reason for their being so highly skilled, something to look forward to in order to give them satisfaction for what they have done. I don't think that you can put this into a program. This is something that can probably be done best by the formal lecture. For instance, I normally spend four lecture hours on the Class V foil procedure. If I could use just one of those lecture hours for the philosophical approach and put the other three lecture hours into the program, I could save three hours of time. We could use these machines to teach the technique phase of dentistry and achieve a time saving there. The students might want to review for their state board exams and there would be great saving there from the teacher's standpoint.

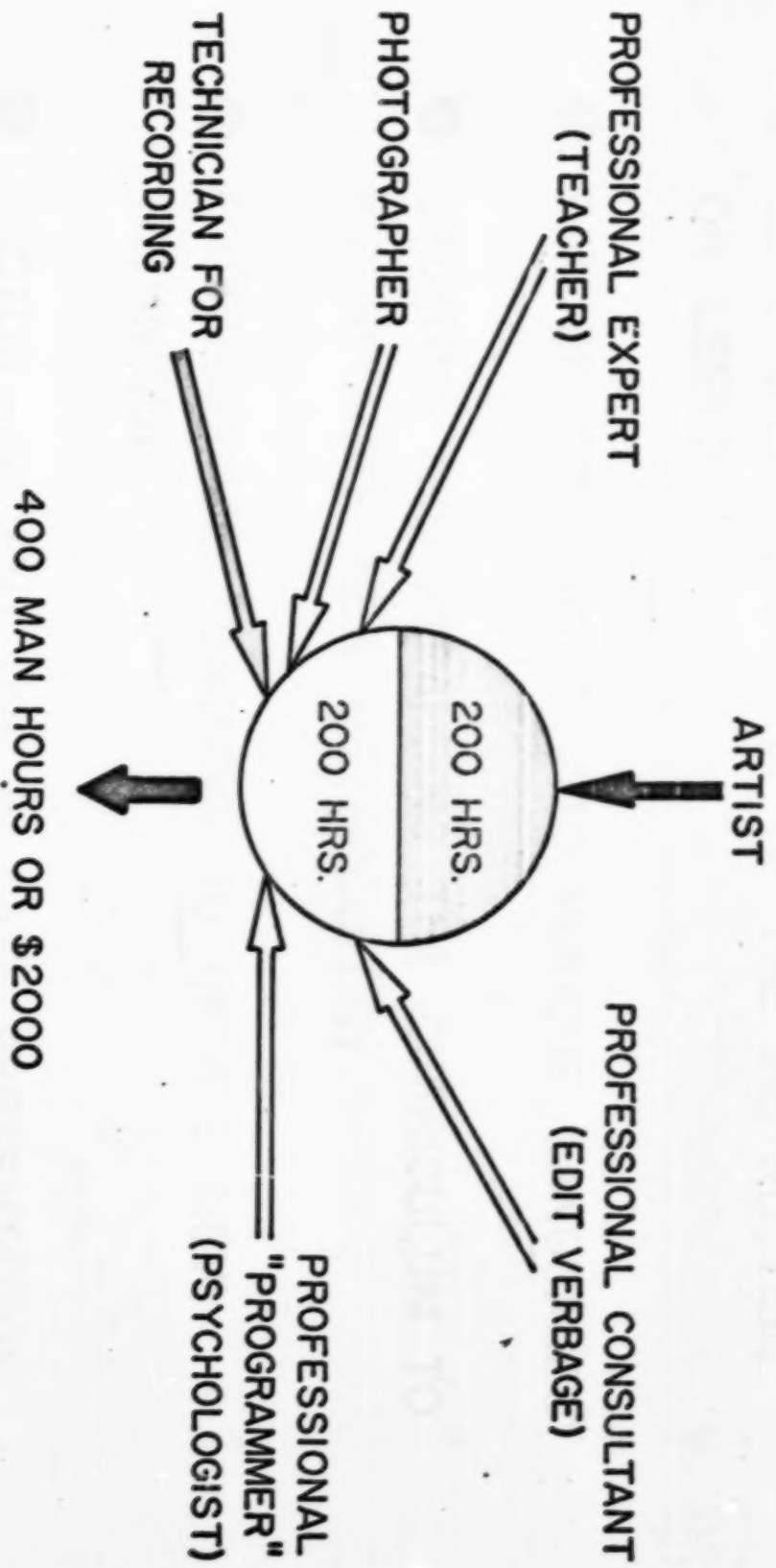
Being a professional teacher, I wanted to know what these programs would do for me. I was the one taking the beating from...well, you just get tired hearing yourself talk. You have 30 students on these special exams on a day, and by the end of the day you get tired of your own voice. You get tired of saying the same things over and over again. I was interested in what it would do for me. In this small experimental procedure it certainly saved a lot of my time, because I could send the student right in to this machine and have him review the point that he had missed. It allowed me time to spend on some of the other interests almost every teacher has. It gave me a chance to use some of this time for more detailed clinical teaching with some of the students who were in real rough shape.

There's a problem here of finding time to counsel these students. It would give me some time to take care of some of these problems.

The administration of the school is interested in the financial involvement of these programs. A 20-minute program such as you have seen demonstrated is going to cost between two and three thousand dollars depending on how much art work is involved, how many slides are to be made, etc. The return of this investment can be gauged by the time saving achieved. If the teacher's time can be judged at \$10.00 per hour and an average of 3 hours can be saved per examination period and there are 10 exam periods per year there can accrue a \$300.00 time saving just on the examination days. When expanded into all the applicable teaching phases it appears that the program could repay itself in probably a two year period just in the amount of time saved. This has not considered the things that could be achieved during this "additional" time nor has it considered the possibility of a better trained student by use of the machine.

As you can see, our experience in programming has been little but it is a beginning and we are enthusiastic about the possibility of this teaching technique for our future classes.

DENTAL AUDIO-VISUAL PROGRAMMING TEAM



ADVANTAGES

- ELIMINATES CONFUSION OF THE INSTRUCTION OR LESSON
- CAN BE CONVERTED INTO VARIOUS LANGUAGES
- UPDATING AND EXPANDING THE CURRICULUM TO INCORPORATE NEW METHODOLOGY
- POSTGRADUATE TEACHING TO UPDATE NEW TECHNIQUE
- DOCTOR - PATIENT USE IN CASE PRESENTATION IN PRIVATE PRACTICE

FREE INSTRUCTOR FOR:

- PURSUIT OF MORE PROGRAMMING FOR
BETTER LESSON TEACHING
- RESEARCH PROJECTS
- MORE DETAILED CLINICAL TEACHING
- COUNSELING TIME
- "ADMINISTRATIVE BURDENSOME DUTIES"

ECONOMICS

PROFESSIONAL TEACHER = \$10 PER HOUR



IN ONE CLINIC TEST → RELEASE APPROXIMATELY

3 HRS. OF INSTRUCTION



TIME = \$30

10 STUDENTS (REPEATS) AT 60 MIN. EACH = 10 HRS.



RELEASE TIME OF APPROXIMATELY 10 HRS. OR

\$100 PER TEST

ECONOMICS

- WITH ONE CLASS OF 10 CLINIC EXAMS, A YEARLY SAVING OF \$1000 OR 100 HRS.
- SAVING OF TIME IN 3 OF 4 LECTURE COURSES
- POSTGRADUATE COURSE (2 PROFESSORS)
- USE IN SOPHOMORE LABORATORY TEACHING
- SENIORS FOR "REVIEW AND TESTING" (PREPARATORY TO STATE BOARD) 2 TEACHERS
- PROGRAM COST PAID FOR IN 2 YEARS

\$1000	OR 100 HRS.
30	3
60	6
30	3
60	
60	
\$1180	OR 118 HRS.

AUTOMATIC TAPED-SLIDE SEQUENCE AS A
LOW-BUDGET TEACHING MACHINE

by

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Abstract

The automatic taped-slide sequence utilizes a tape recorder, slide projector, and a small inexpensive synchronizer which advances the slides by a predetermined signal which can be put on the tape.

The teacher can prepare a set of teaching slides, and present the oral material on tape for use as a low budget method of increasing his effectiveness and providing individual students opportunity for review. The teacher is also introduced, by this simple means, to programmed learning and teaching machines.

I would like to discuss with you the possible uses of the automatic taped-slide sequence as a method whereby this experiment in education and learning theory can be more easily accepted by faculties in different schools.

As a means of education for teachers, the automatic taped-slide sequence should accomplish two things: (1) Allows the teacher to review the materials which he has used for 10, 15, or possibly 20 years, a process which time and the exigencies of crowded daily programs rarely permit the teacher to do. The preparation of a taped-slide sequence allows the teacher to reorganize, review and revitalize

His old teaching material. (2) For both the older teacher and the newest faculty member this is a simple means whereby he is introduced to and begins to think of programing and teaching machines, which, I sense, is sometimes resisted by those who know little about them, as something mechanistic.

The automatic taped-slide sequence is nothing more than an automatic tape recorder and a slide projector. If you hook them together through a synchronizer or programer, it is possible to change the slides automatically through a high frequency sound or a sense mark on the tape, so that the tape trips the slide mechanism and projects the next slide. And that's all there is to it. Many schools do not have the financial resources to experiment with newer sophisticated teaching devices and materials. However, most schools have a projector and a tape recorder and the average synchronizer ranges from \$35.00 to a rather excellent one for about \$55.00.

Originally, the taped-slide sequence was conceived as a teaching device, an audio-visual aide in our Pedodontics Department for the purpose of allowing the student to get the material we would like to present somewhat more quickly and more palatably. It has distinct advantages over the sound motion picture, which requires a highly skilled technical photographer and which is somewhat more expensive for teaching technical and clinical procedures. Our method has certain advantages over the television because even a good television program tends to be forgotten, but this method captures things on film and can be repeated.

At the present time we feel that its greatest usefulness is in the re-education of the dental instructor, especially the teacher of

techniques; pre-clinical technics as well as clinical procedures. It also should be very helpful to the teacher of histology, who has many slides to project. If these slides are carefully photographed with modern photomicrograph techniques and programed properly, perhaps some time can be saved in the average histology course.

We have experimented with the presentation of oral lesions and clinical oral pathology using this device and found it extraordinarily effective, since it permits the teacher to correlate the clinical picture with the histologic picture. Many teachers have these slides available--but not always used. They could be scrutinized, oriented and put into a programed sequence. Perhaps the anatomy teacher would find this device helpful in the presentation of his anatomical material.

This method has a distinct advantage over other audio visual media in that 35 mm color film enables the teacher to present his material at high magnification. For example, if we want to show a freshman dental student what a root canal reamer or file, or bur looks like, it is very easy to photograph this at a one to one ratio with an extension bellows attached to a single-lens reflex camera that most schools have. When you project this slide on the screen, it's magnified anywhere from 30 to 60 times. Looking at the students' reactions in the class is interesting. The sheer size of the image has a tremendous impact. They are amazed. I am not sure whether this promotes learning or not, but I would suspect it does this better than the usual technique of asking the student to examine his instruments with the naked eye or a simple magnifier at times. Unhappily, we all recognize that most dental practitioners and students are not as well aware of the finer details of the instruments they use as they might be.

For example, if you are teaching a student how to sharpen a hand instrument, using only the naked eye (which no researcher would depend upon) he cannot see the fine details of the differences between a dull and sharp instrument. He therefore loses much of your teaching if he does not examine the edge under magnification. On the other hand, if you were to take a color slide of a sharp instrument, a dull instrument; and the sharp instrument after you had used it to chip through enamel; then project these onto the screen in high magnification, the impact on the learner is tremendous. This is difficult to achieve with television unless you have an unusually good cameraman and a good lens system. The lines on the television screen have their limitations. I agree you can magnify considerably on the TV screen, but not quite as large, nor is the image as sharp. With still pictures, which are held on the screen for approximately 8 to 10 seconds, the student's eye sees the object in sharp detail, as well as in high magnification. This is difficult with the moving picture, which flickers even with 24 frames per second, so that there is some indistinctness in the visual image and eye fatigue. This is not true of the still picture. We find that its fine detail is a great asset to the teacher, especially the teacher who is technique and instrument oriented, and wants clarity and detail.

Editing of the taped-slide sequence is very simple. You just take out a slide and replace it with a better slide. This is not too difficult with a movie film, but editorial review is not possible on the television screen.

Another virtue of the taped-slide sequence is that it can be placed in the library, or in a special room, for review by the student. A student who has missed a class, or a student who really

would like to learn the subject a little better, and didn't quite grasp it the first time, should have the opportunity to review that type of material. This should be very useful in the teaching of histology and pedodontic techniques. At our school we spend a lot of time with pedodontic techniques and, although it is a four-year program, we give the students too much material over too short a period of time. Some of these students should be given the opportunity to study our material a little more slowly, to review it once or twice for emphasis. This is fundamentally the biggest virtue of the teaching machine philosophy. I suggest that inexpensive, easily duplicated slides and tapes are simple to use and very effective.

Finally, the 35 mm slide is a familiar object to the teacher, and he has seen and heard tapes before. Some have even played them at home. These are more familiar objects to the teacher and therefore more readily acceptable than asking them to present their material on TV, for example, where they have to practice, may develop a feeling of insecurity and even make fright. An unrehearsed television performance can sometimes be embarrassing if not disastrous.

As will be reported by Dr. Thomas K. Barber in the Journal of Dental Education, we have accumulated data which show that on the average, the one hour lecture is cut down to about 20 or 25 minutes with a programmed taped-slide sequence. In analyzing what occurred, we found the small stories that the teacher is accustomed to telling, and the clinical cases that he recalls spontaneously (sometimes in fantasy) to emphasize his point, are eliminated. Now, at the end of the first year we questioned whether this was a good thing because it seems that the students liked these little stories and our teacher said it's a pity we eliminated them, because it lost the personal

touch. Evaluation suggests that we have lost the entertainment value, but we have significantly increased the learning situation because recall is much better when you make your points clearly and directly and don't branch off every few minutes into a small story. After an "entertaining" lecture, many students asked, "What was the connection?"

The sequence of the points that a good teacher wishes to present is frequently diluted by entertaining little tales, which, in the hands of a skillful person, emphasizes the point, but in the hands of an untrained speaker, dilutes the point. The taped-slide sequence very significantly hews to the line. We also obtained data from different instructors who were watching the class and its behavior patterns. The attention span of the class was markedly increased when it listened to a carefully prepared taped-slide sequence. That is, they paid attention to the points because the points were in sequence.

How do we go about preparing a taped-slide sequence? The teacher is requested to present his material through the medium of a tape recording, which can be synchronized to a slide. Step one is to have him review his slides. He sometimes discovers that half of them are not up to the standard he thought they were when his was a casual presentation. He usually asks for additional visual material, which in itself improves our teaching program. Much of the material is easily photographed with the use of an ordinary 35 mm single lens reflex camera. Teachers should learn to use a camera and use it in the clinic. Much valuable clinical teaching material escapes every day because the instructor is not visual aid conscious. Perhaps he has never used a camera for recording clinical lesions or before and

after treatment procedures. But the average dentist learns quickly and soon becomes an excellent clinical photographer.

After his slides are all prepared the instructor is then asked to take his slides into a room with an ordinary tape recorder and record his lecture, not for permanence, but so he can hear it back.

We suggest that he program his material, and he says, "What's programing?" Well, it's no use telling him to read Skinner or to read some of the new books on programing. He hasn't time for that, but if we explained that programing means he should present his material in short bits, having a major caption for each bit, he'll understand. Then he asks, "How does the student test himself for right and wrong?" We programed our material by spending the first 20 minutes presenting the factual material, followed by a period of 12 minutes setting up criteria and standards for the students' evaluation. When you are teaching the pinching of a band, don't show the one pinched band as you see it subjectively. Prepare bands of A, B, C, D, and F quality so the student has an idea what you mean by good or bad bands. This is a very essential business--setting up criteria whereby the student can evaluate his own product, when it comes to an inlay, for example. We discovered that the teacher had been grading inlays and band construction on a highly subjective basis and did not have a clear set of criteria whereby he could distinguish between an A, B, C, D and F inlay. Under these circumstances, our students could not evaluate their own inlays either. They also became quite confused by the seeming differences between instructors and sometimes the different grades given by the same instructor on different days. Evaluation is wonderful, providing you use a measuring device. Evaluation which is subjective and erratic isn't evaluation at all.

The synchronized taped-slide sequence establishes the criteria and standards which you wish to provide so the student can evaluate his own product before showing it to the teacher. This matter of setting up criteria for evaluation is also important for the teacher. The teacher can now say, "This is an excellent band, or retainer, or amalgam. The reasons are: point one, two, three". Or he can say, "This is a poor one and I would grade this a C because of point one, two, three", without fear that his colleague will contradict him-- but rather support him. At the same time he re-emphasizes the points made in the first part of the presentation.

Following the "criteria and standards" phase, there is a 7-minute self test, where an extracted tooth, a technique case, or an unknown pathology slide, for example, is projected, and the tape goes silent for 15 seconds. The student is asked to grade this slide or identify the cells. He puts it down on paper in the semi-lit room, and following this 15 seconds, the teacher's voice comes in and describes, "I have graded this an A because it satisfied the following requirements", or "I graded this a D because there is too much solder at the joint, and it is impinging on the gingivae". The objective is to help the student decide whether he understands what has been projected. Understanding must precede problem-solving. I believe problem solving is much more important than memory recall, because dentistry doesn't involve stereotyped techniques.

In summary, the automatic taped-slide sequence is an audio-visual aid presented as an educational device for both students and teachers, utilizing rather low cost, simple equipment. This simple technique can help the average teacher to review his own material and assist him in his job as an educator. It is suggested that this device might be explored by dental educators and dental teachers as an introduction and preparation for more sophisticated programing and teaching machines.

ANIMATED SERIAL SECTIONS

by

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Abstract

This presentation demonstrates a technique for preparing color slides in motion picture sequence of the upper dentition of a fetus in a manner designed to show dental students a three dimensional concept in anatomy.

This paper reports a unique method for the visual presentation of anatomic material with improved three-dimensional orientation. The method requires the use of colored motion picture film on which has been reproduced a sequence of stained serial sections of the anatomic area under consideration.

In using a film so prepared, the time factor allows the development of a desirable illusion of depth. In other words, the film presents at any one time a two-dimensional display of some particular plane of the area being studied. But as the film progresses, the plane of presentation moves deeper and deeper so that the observer makes a visual excursion through the block of tissue. In the course of this excursion, his memory of what he has seen previously, coupled with what his eye beholds at the moment, gives him a psychologically integrated concept of depth.

In the preliminary work for developing this method, a study was made of the upper jaw of a human fetus. The reason for selecting

this small region is that, due to its varying rates of differential growth, it presents a challenging combination of anatomic relationships. It includes the buds of at least 12 teeth, the developing nose, and the nerve and blood supplies of these structures. The term "differential growth" is used to describe the amount of growth in one of these structures in comparison with growth in another.

There are several conventional visual aids, the discriminate use of which can help the student to develop a concept of the three dimensions of such a complex part of the body. A few of these, with their respective limitations are:

1. Photographs or lantern slides of a dissection. Depending on the nature of the original dissection and the quality of the photography, the reproduction may give more or less of a third-dimensional concept. At best, however, the image on the screen is static.
2. Glass-mounted tissue sections which may be projected on the screen either directly or by colored lantern slide reproductions. Although sections in the series may be taken at various levels of the area being studied, the visual image is limited to two dimensions.
3. Photographs or lantern slides of a model produced by the wax plate reconstruction method. Although such a model has been built up sequentially from serial tissue sections and thus gives an accurate concept of proportions, it is inherently opaque and, therefore, cannot show internal structures and relations.
4. Lantern slides showing relief-map type of graphic reconstructions based on sequential tissue sections. These contribute to the third-dimensional concept but they are deficient in detail.

A fifth method, a film, is described herewith. A film synthesizes the advantages of all four methods listed into a unique learning experience. Although not an actual dissection, it shows the course and relationships of the structures encountered. It enhances the advantages of glass-mounted tissue sections, from which it is derived. Compared with an opaque model constructed by wax plates, it permits observation of the internal structures in each of the planes encountered. The discernment of depth is achieved through a moving sequence of presentation rather than by sketch contour lines.

The method being presented is versatile for it may be adapted to the demands of many specific lines of study. The differential staining of the tissue sections, from which the film is made, can be chosen to emphasize whatever fundamental tissue is under scrutiny. The plane in which the tissue sections are cut may be arranged to show the course of a nerve trunk or blood vessel as may be desired. Once prepared, the film may be shown in forward or reverse order as lends itself to the needs of the moment.

The laboratory technique of preparing a fetal head for such a film is routine, decalcification followed by embedding in celloidin. One exception exists--the supplying of a standard point of reference by which one section of tissue can be oriented to another. One method of accomplishing this mark of reference is to drill parallel holes, 1 mm. in diameter, prior to sectioning. One such hole is at nasion, and one at some other point. (A readily available drill may be made from .040 inch chrome-alloy round wire available at Dental Supply stores). The celloidin embedded and marked head is now positioned in the microtome, and serial, frontal plane sections cut, ranging in thickness from 30 to 120 μ . The thickness of the sections

is uniform for each fetal head. The serial sections are numbered as they come from the blade of the microtome, then stained and mounted on glass slides.

The ideal method of procedure would be to photograph each section while it is still a part of the block of tissue and oriented in the microtome. The reason that this method is not presently possible is that the stain will not uniformly penetrate the mass of tissue present in the unsectioned head. Therefore, to portray the distinctive characteristics of structure, glass-mounted, stained, serial sections are necessary. Each mounted section is then photographed.

Although it is possible to employ a single projector to produce a film portraying serial sections, twin projectors have proven more satisfactory. A study of the illustration reveals that the two Kodak 500 (four inch, f 3.5 lens) projectors are aligned so that the beam of light of the projector for reproduction is aimed at the screen, and the beam of light of the projector for reference is parallel to the screen. The beam of light from the first passes through the 50% mirror to the screen. The beam of light from the second is reflected from the mirror to the screen. Thus the 50% mirror, oriented at 45° to the screen and projectors, serves the purpose of directing each of the half-intensity-beams of light to the same area on the screen. Such an arrangement is necessary to avoid the distortion due to parallax.

A very accurate alignment and determination of the degree of enlargement may be obtained by superposing on the screen the projected image of glass 10 mm microscope reticules which have been cemented to glass slides. The actual preparation for photography gets under way with the placing of a glass-mounted section of tissue in the reference projector. The image of the tissue is then shown

on a white formica screen. The screen enhances the brilliance of the stain and decreases the reflection into the camera lens. The slide is then aligned in the sagittal and horizontal (Frankfurt) plane. The next slide of the series is then shown from the projector which is designated, in the illustration, as that for reproduction. The images of the two sections of tissue may now be rather accurately superposed by moving the reproduction slide about in its projector. Two factors which lend facility to such orientation are the 1 mm diameter holes drilled as landmarks (and previously described) and slide holders designed to allow movement of the slides in four directions. Such slide holders are necessary, as the projectors cannot be moved without introducing distortion into the film.

After the images of the two sections of tissue have been superposed on the screen, the reference projector is turned off and the slide in the reproduction projector photographed. A third slide, placed in the reproduction projector is similarly aligned and photographed before it is necessary to change the reference slide. Each subsequent reference slide is aligned with the immediately preceding reproduction slide, before the latter is removed from the projector.

The actual photography is accomplished with a 16 mm Bolex Reflex camera. The purpose of the dissolves is to give a smooth transition from one serial section to the next. Photography accomplished without the dissolves results in a very jumpy sequence. The primary cause of the jumpiness is probably the distortion that results from the processing of the tissues. The ratio of the frames per dissolve to the frames of tissue sections photographed may be varied at the discretion of the photographer.

The classroom presentation of such a film is preceded by a

discussion which involves any or all of the previously listed conventional methods of audio-visual instruction. Attention is devoted to selecting several representative sections of tissue from the series used in making the film. The chosen slides are projected to the screen and thus used to call attention to structures of particular interest to the day's discussion. The film is then run, discussed, and re-run in whole or in part, as desired.

SUMMARY:

1. A colored movie film produced from the photographing of serial, stained, glass-mounted sections of tissue may be used in the classroom to develop a desirable illusion of depth of anatomic structure.
2. The limitations of four other conventional methods of visual instruction have been discussed. The four are: (a) photographs or lantern slides of dissections, (b) the projection of glass-mounted sections of tissue, (c) photographs or lantern slides of models, and (d) lantern slides showing a relief type of graphic reconstruction.
3. The method presented is versatile and may be adapted to the demands of many specific lines of study. A particular advantage lies in the ability to employ techniques of differential staining, or to vary the plane of section in which sections of tissue are cut, and thus emphasize the fundamental tissue under scrutiny.
4. Such a film makes use of anatomical material that is generally available in the laboratory. There is little delay in producing it for immediate use. It is economical in terms of the cost of time and the supplies required for the production of the film.

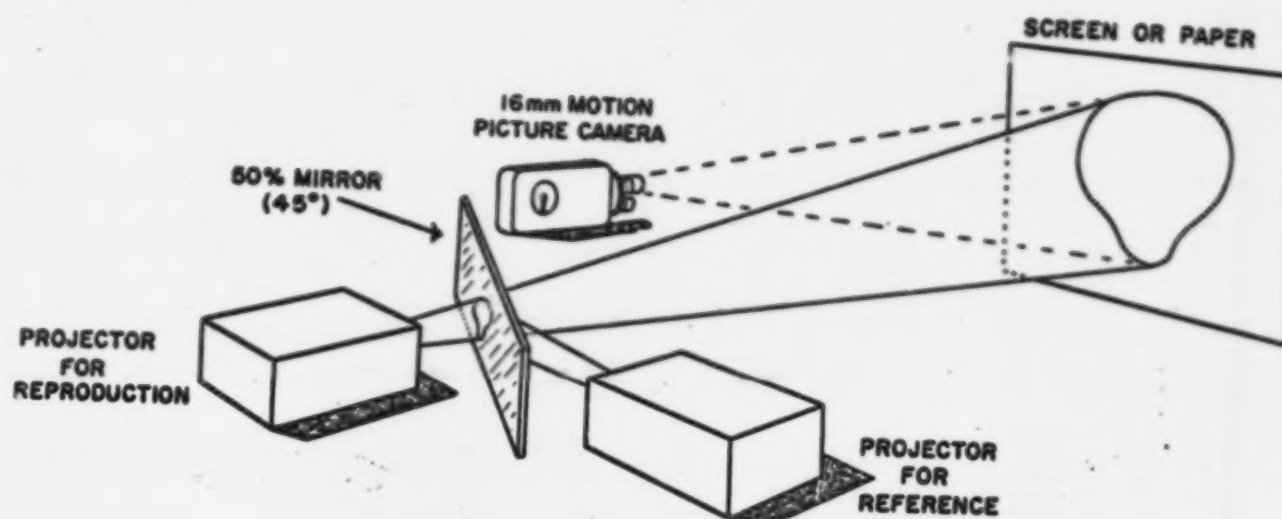


Figure 1

THE ILLUSTRATED LECTURE ON LESIONS
OF THE INFRABONY POCKET

by

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The material presented utilizes many teaching aids and attempts to correlate basic science with clinical surgical procedures so that a better understanding of this academic discipline may be developed.

In the field of Periodontics, we are most frequently called upon to treat a chronic destructive inflammatory disease which has as its sequelae the loss of the supporting tissues surrounding the teeth. This inflammatory process progresses slowly permitting proliferation of the attached epithelium rootward and the subsequent detachment of the gingival or gum margin from the tooth forming a pocket.

Once a basic background is developed through intensive lectures on the pathogenesis of these lesions and correlated with exhaustive examination of the literature on the subject, the following teaching tools fall into a logical pattern in the development of a thorough understanding of the subject.

1. The use of classification charts enable the differentiation between the various types of pockets - suprabony and infrabony, enabling uniformity and common understanding during discussion.
2. The Photomicrograph - confirms histologically that difference exist between the lesions falling within the classification
3. Diagnostic sketches further aid in understanding the approach to diagnosis and adds to the mental picture, building a solid basis for management of this type of disease process.

4. The radiograph, an indispensable tool in diagnosis, can not alone clearly elicit the defect under discussion. The radiograph must be used in conjunction with some radiopaque material for example, the periodontal probe, diagnostic silver points, or gutta percha points. Only in this way can the location of these vertical resorptive lesions be correctly identified.

5. Dry skull material begins to approach the in vivo problem at hand. The typography of the gingival tissues are very deceiving and only through training and perceptive visualization of the underlying osseous defects can the concept of these infrabony pockets be understood. Dry skull material, pointing out that which would seemingly be a normal anatomical osseous contour in one view, reveals a three-walled defect when viewed from the lingual aspect.

6. Transparencies are projected duplicating almost exactly surgically exposed osseous defects that enable correlation between the personally examined dry skull material.

7. Technic diagrams are viewed showing instrumentation levels of tissue removed, step by step performance of the procedure, histologic structure involved and post surgical management of wound.

8. Television demonstrations of the operation adds additional chairside experience prior to actual student performance.

9. Concept of cure is developed and correlated with pre-treatment radiographs with opaque material in situ compared similarly with post treatment radiograph. Difference in level of penetration is noted.

10. Student performance under careful guidance of an instructor.

Only through utilization of comprehensive teaching aids can an approach to complete understanding be attained.

MULTIFACTOR ANALYTIC TECHNIQUES FOR EVALUATING HARDWARE
AND SOFTWARE IN MAN-MACHINE ENVIRONMENTS

by

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Abstract

This paper briefly describes an analytic technique for making crucial decisions regarding choices between human instruction and machine instruction and for pursuing these choices to realistic conclusions.

A frame of reference is first established by delineating and differentiating the performance aid, the communication aid, and the general-purpose teaching machine. Next, the evolution of these as "movements" in the fields of industrial engineering, behavioral science, physical science, and management science, is traced from the original efforts of Herbart in Germany. Superimposed on this grid of "hardware" is another of "software" which is generally considered to consist of job analysis, lesson planning, and performance testing.

A systematic examination suggests that medical and dental educators will probably concentrate on reengineering the student rather than some other solution. A flow-chart is presented which permits a variety of paths ending in a "transfer to real-life situation". A feedback loop to "establish occupation performance standards" is identified.

A second flow-chart begins with "decide: machine instruction"

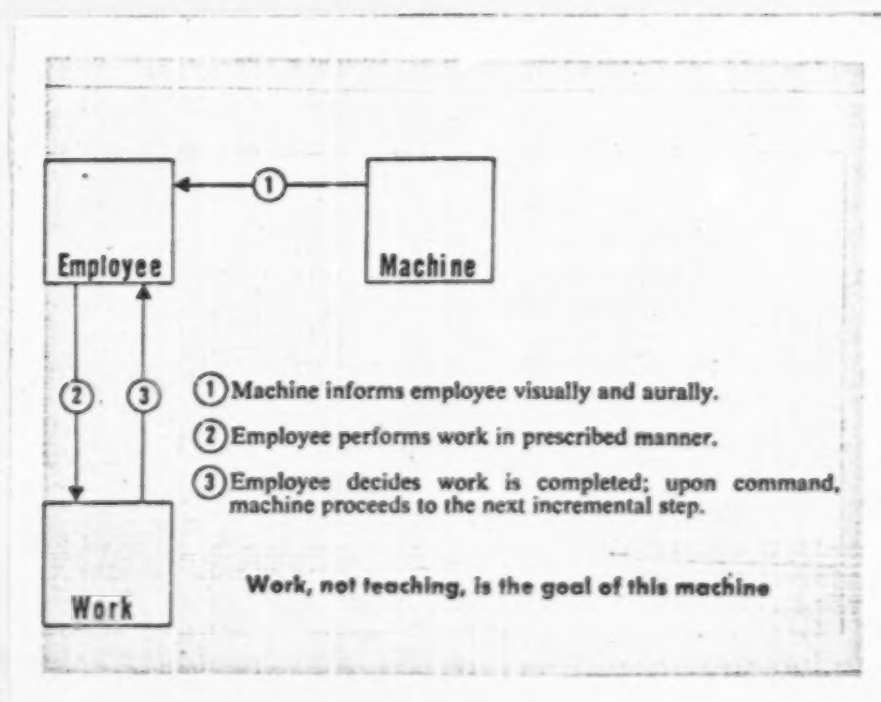
and sets up paths for decision-making by the medical and dental educator. Such critical matters as "make or buy" and "programed text or machine format" are graphically analyzed. The functions of write, tryout, validate, produce, evaluate, and the logistic function for actually manufacturing program materials are shown in a proper sequential perspective. It is concluded that medical and dental education systems might profit by the early application of very large systems engineering techniques in this area.

MULTIFACTOR ANALYTIC TECHNIQUES FOR EVALUATING HARDWARE AND SOFTWARE IN MAN-MACHINE ENVIRONMENTS

A. Establishing the Gestalt

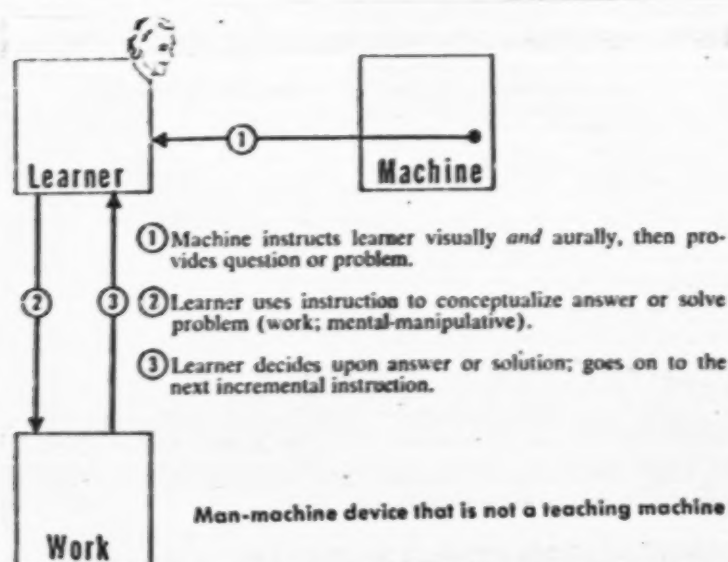
The introduction of the performance aid technique in manufacturing and service environments coupled with the emergence finally of programed learning and teaching machine technology has impacted upon every facet of education and training.

The performance aid is described by this diagram:



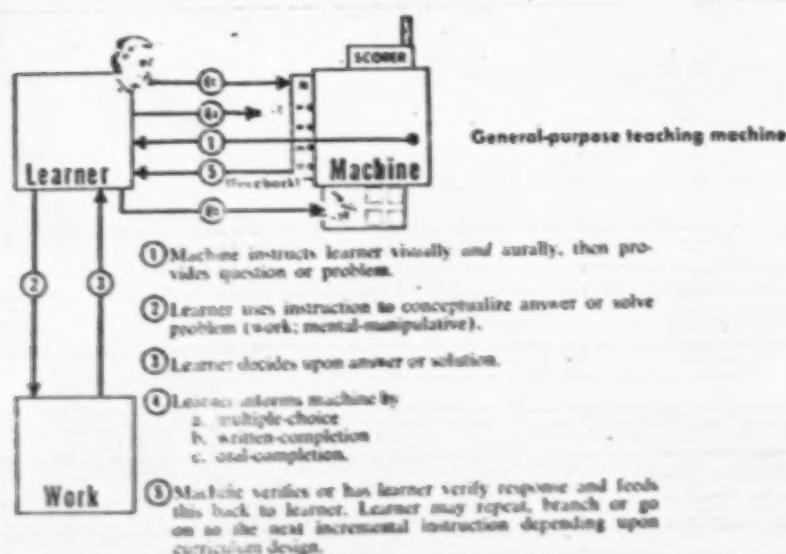
It should be noted that this method informs rather than instructs since the goal is work rather than learning. Learning is defined as the acquisition, understanding, and retention of knowledge and skill for regurgitation and transfer later to real-life situations. While some learning may occur with this method, it is random and casual rather than directed and explicit.

The communication aid is depicted by this diagram:



While this is a man-machine system designed for learning, it is not a teaching machine even though learning may result.

The general-purpose teaching machine or programmed learning method is described by this diagram:



To comprehend the "supra-system" of which these movements are merely systems, one must trace historically the evolution of all the movements (1,2). The chart in Figure 1 depicts the supra-system dealing with human performance. This system consists of super-systems: manufacturing, instructing, engineering and managing. Each in turn has clearly identifiable movements or systems which are machine-oriented: in manufacturing, characterized by industrial engineering, are found the performance aid and communication aid; in instructing characterized by behavioral science are the instruction aid and two sub-categories of teaching machines--special-purpose and general-purpose; in engineering or the physical sciences are the learning machine, computing machine and environmental machine; in managing or management sciences are found three machine systems, decision-making, model-making and command/process-control.

Superimposed upon this network of machine or hardware-oriented (hardware being a synonym for machine) systems to improve human performance by reducing human error, is another network. This is essentially a "software" network. Since the medical and dental professions normally are unaccustomed to conceptualizing networks as being "hardware" or "software", we must turn to the mathematicians and engineers in the computing machine system for definitions. Ad hoc definitions have been established by the Sub Committee on Programing Terminology (SCOPT) of the Association for Computing Machinery (ACM) beginning in June, 1954, the latest being (3):

"hardware: the physical equipment such as the mechanical, magnetic, electrical and electronic devices from which a computer is fabricated; the material forming

a computer, as distinct from the routines.

CONTRAST WITH: Software."

"routine: 1. a set of coded instructions arranged in proper sequence to direct the computer to perform a desired sequence of operations.
2. a subdivision of a program consisting of two or more instructions that are functionally related.
3. a program."

"software: the totality of programs and routines used to extend the capabilities of computers, such as generators, compilers, assemblers, and operating systems. CONTRAST WITH: hardware."

In the field of human performance, the "software" techniques have been "engineering task analysis" in manufacturing, "job analysis --lesson planning" at the interface of manufacturing and instructing, and "performance test" in instructing.

B. Medical and Dental Applications.

Looking first at the performance aid and the communication aid, it is observed that some early interest was in evidence in the late 1950's although an effort to accurately document this has yielded poor results. Silvern and Salmen reported on several man-machine experiments for mentally-retarded patients in the Spring of 1961 (4, 5).

Again in the teaching machine and programed learning system, while some direction was provided by Stolurow at the University of Illinois faculty workshop held at the College of Dentistry in March of 1961, until this conference not much documentation describing the use of this methodology for medical and dental studen

for patients under medical or dental treatment, or to continue the professional development of the graduate practitioner, has appeared (6).

It is evident that the proceedings of this conference will represent the first major attempt to bring into sharp focus the extent of applications in the medical and dental occupations.

C. Multiple Factors Constituting a Systematic Approach to the Identification and Creation of a Total System for Curriculum Development

Since business, industrial and governmental organizations have popularized systems engineering and operations analysis techniques it may be well to consider the problem from that frame of reference. We shall quickly move to the "education in the university" track and concentrate on it, leaving education of patients and professional development of the graduate practitioner for another time. Reference now will be made to Figure 2 and to the coding numbers appearing adjacent to each rectangle. A rectangle represents an action function to be performed. This action function required decision-making by one or more individuals engaged in organizing and operating a programmed learning effort. The decisions will involve both hardware and software. The arrows represent major signal or communication flow between action functions. Only major signals are depicted; minor signals which have only moderate influence are not included in this analysis although they usually appear on more detailed charts. The term "practitioner" will be used to identify practicing graduates of medical and dental schools; "student" is used to describe practitioners-to-be.

- 1.2 Eliminate the Man. Since practitioners are necessary because patients are as yet unable to satisfy their own medical and dental needs by themselves, students cannot be eliminated.
- 1.4 Eliminate the Job. More and not less medicine and dentistry are demanded. Consequently the technical tasks cannot be eliminated.
- 1.3 Re-engineer the Job. Medicine and dentistry seem to have successfully introduced and accepted hardware in the practitioners office, in the clinic and in the hospital. In this respect, the job is continually being re-engineered. Whether the job, per se, is being improved by systematic analysis or whether change occurs on a random basis by the injection of non-integrated invention and discovery is worthy of further investigation.
- 1.1 Re-engineer the Man. The most difficult solution is to change the man: as a student learning in a university (2.), in a specialized training program (2.2) or informally (2.3).
- 2.1 Educate Formally (University). It is traditional to prepare professionals by educational processes in universities. There are times when one is not sure whether it is "training" which is offered or "education". The questions and arguments dealing with this make grist for some other mill. In this paper, it is assumed that physicians and dentists are educated as students in the university system.
- 3.0 Establish Occupation Performance Standards. The key to understanding human performance is in the standards established as a value system for performance in the occupation.
- 4.0 Produce Occupation Analysis. The occupation for which education is to be provided must be analyzed at the outset and

compared with the performance standards previously established in 3.9. Because all trades, crafts and professional occupations are dynamic and change as new skills, methods, materials and machines are invented and introduced, this analysis and its accompanying comparison must be made continually throughout the life of the education program.

In other words: forever!

5.0 Develop the Curriculum. Curriculums should develop from and be attentive to the needs of the occupation. Therefore, curriculum change in technical fields such as medicine and dentistry should be expected. These have tended to produce essentially three kinds of learning environments:

5.1 classroom experience; typically lectures, demonstrations, discussions (low-fidelity simulation).

5.2 laboratory experience; typically laboratory problems under professorial direction (medium-fidelity simulation).

5.3 work experience; typically clinic assignments where real-life conditions exist but under the direction of first-line supervisors (maximum-fidelity or real-life).

6.1/6.2 Synthesize Course Outlines. From the performance standards and occupation analyses viewed from the educational goal point of view comes a synthesis of the subject matter into a mix of work experience - classroom experience - laboratory experience. This evolves naturally into courses, units and lessons (7).

It is at this point that the medical or dental educator must begin a decision-making process which concludes with these kinds of outcomes:

- 7.1.1.0 Machine instruction for the classroom experience
- 7.1.2 Human instruction for the classroom experience
- 7.2.1.0 Machine instruction for the laboratory experience
- 7.2.2 Human instruction for the laboratory experience

Of course, each of these would not be absolute for an entire curriculum or even an entire course. The most reasonable level for decision-making is probably the "lesson".

If the decision is human instruction for the laboratory experience (7.2.2), then lab problems are developed (7.3.4.0), a laboratory manual is created (7.3.4.1), the laboratory is instructed (8.1.5), hopefully a performance test is established (8.1.6), the outcome is evaluated (9.0), this is compared with previously established performance standards (3.0) and with transfer by practitioners to their real-life situation (10.0) thru varied techniques of feedback.

If the decision is human instruction for the classroom experience (7.1.2), then lesson plans are developed (7.3.2.1), texts, workbooks and textworkbooks are created (7.3.2.3), written tests are produced (7.3.2.2), instruction aids are prepared (7.3.2.4) and all of these are translated into human classroom instruction (8.1.3) which is then evaluated (9.0) and the outcome compared with the same previously established performance standards (3.0) and transfer by practitioners to their real-life situations (10.0).

If the decision is machine instruction for the classroom experience (7.1.1.0), then the process is no longer traditional or well-known and some special decision-making occurs which will be described in detail later on. The machine lesson plans or

software (7.3.1.0), are developed and accompanying them is the integration of criterion self-tests (7.3.1.1). The machine instructs (8.1.1), an external test is administered (8.1.2) the outcome is evaluated (9.0) and compared with performance standards (3.0) and transfer to real-life (10.0). Incidentally, 8.1.2 might consist of pre-tests and post-tests or merely post-tests alone depending upon the extent of quality control and the precision desired.

If the decision is machine instruction for the laboratory experience (7.2.1.0), laboratory problems or software are devised (7.3.3), and instructed (8.1.4), a performance test is administered (8.1.5), an evaluation occurs (9.0), and the customary comparisons (3.0) and (10.0) conducted.

D. Multiple Factors Constituting a Systematic Approach to the Identification and Creation of Hardware and Software.

Reference is now made to Figure 3 depicting the paths and factors which involve "make or buy" decisions, "programed text or machine format" decisions, and others dealing with hardware and software. The decisions in (7.1.1.0) and (7.2.1.0) force the medical and dental educator to examine the "Select Format: Text or Machine" function (7.1.1.1).

If the decision is "programed text" software then a "produce or buy" decision is next required (7.1.1.2). Let us assume that it is produce. Then the order of events would be --

write (7.3.1.2)
integrate (7.3.1.1)
tryout (7.3.1.3)
iterate (7.3.1.2)
validate (7.3.1.4)
publish (7.3.1.5)

evaluate (7.3.1.5)
 compare (3.0)
 instruct (8.1.1) or (8.1.4)
 test (8.1.2) or (8.1.5)
 evaluate (9.0)
 compare (3.0)
 compare (10.0)
 null error signal (10.0)--- (3.0) --- (4.0)

Significant logistical support functions are:

layout, print, bind (7.3.1.5.1)
 draw art, photograph (7.3.1.5.2)
 store, package, handle (7.3.1.5.3)
 design template (7.3.1.5.4)

If the "programed text" software decision, instead of produce, is assumed to be buy, then the order of events would be:

analyze (7.1.1.4)
 compare (4.0)
 analyze (7.1.1.5)
 compare (3.0)
 decide (7.1.1.3)
 branch (8.1.1) or (7.3.1.2)

If the decision is "machine" hardware and therefore also "machine" software, the next decision would deal with special-purpose or general-purpose hardware (7.1.1.6). Let us assume that it is general-purpose hardware. The "buy or rent" hardware decision (7.1.1.7.0) would be influenced by such factors as

calculate capital outlay (7.1.1.7.1)
 determine mode capability (7.1.1.7.2)
 calculate MTBF (Meantime Between Failure Index) and modification (7.1.1.7.3)
 predict reliability of vendor and availability of apparatus (7.1.1.7.4)
 decide on scorer capability (7.1.1.7.5)

Let us assume a "buy" hardware outcome and move then to the "produce or buy" machine software function (7.1.1.8). If the decision is produce, then the order of events would be:

write (7.3.1.2)
 integrate (7.3.1.1)
 tryout (7.3.1.3)
 iterate (7.3.1.2)
 validate (7.3.1.4)

produce (7.3.1.7)
 evaluate (7.3.1.6)
 compare (3.0)
 instruct (8.1.1) or (8.1.4)
 test (8.1.2) or (8.1.5)
 evaluate (9.0)
 compare (3.0)
 compare (10.0)
 null error signal (10.0) --- (3.0) --- (4.0)

Significant logistical support functions are:

draw art, photograph (7.3.1.5.2)
 store, package, handle (7.3.1.5.3)
 narrate, record (7.3.1.5.5)

E. System Models for Medical and Dental University Education

Education systems have become very large, complex systems. It has been said that systems engineering cannot work in small systems while traditional engineering cannot work in large systems. Perhaps medical and dental education systems can profit at this stage by engineering techniques (8).

It is obvious that a system model for a specific problem can be produced, similar to Figures 2 and 3 which would clearly relate the major functions and major signals to produce prescribed outcomes. No very large system can expect a high order of decision-making in the absence of such a model.

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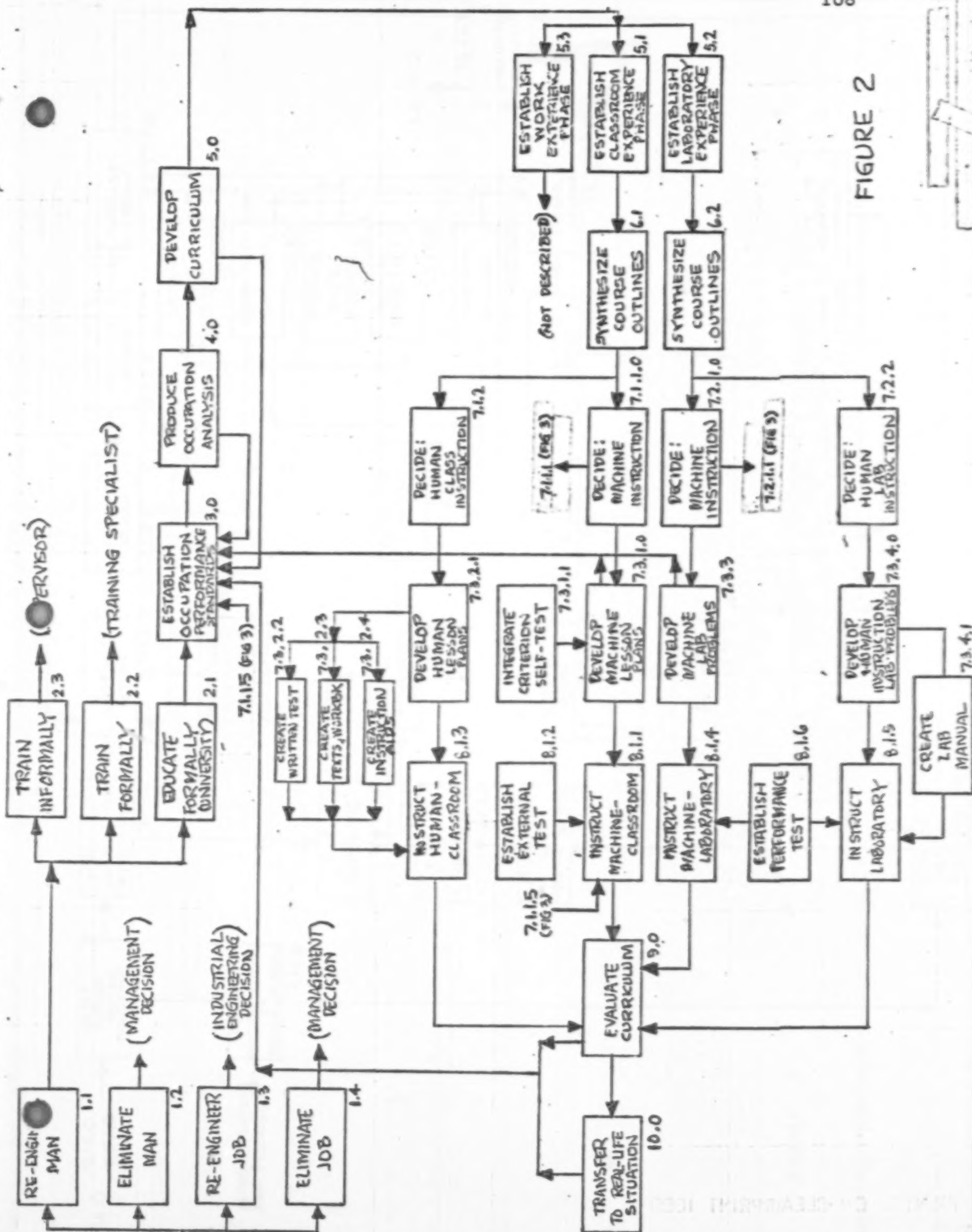


FIGURE 2

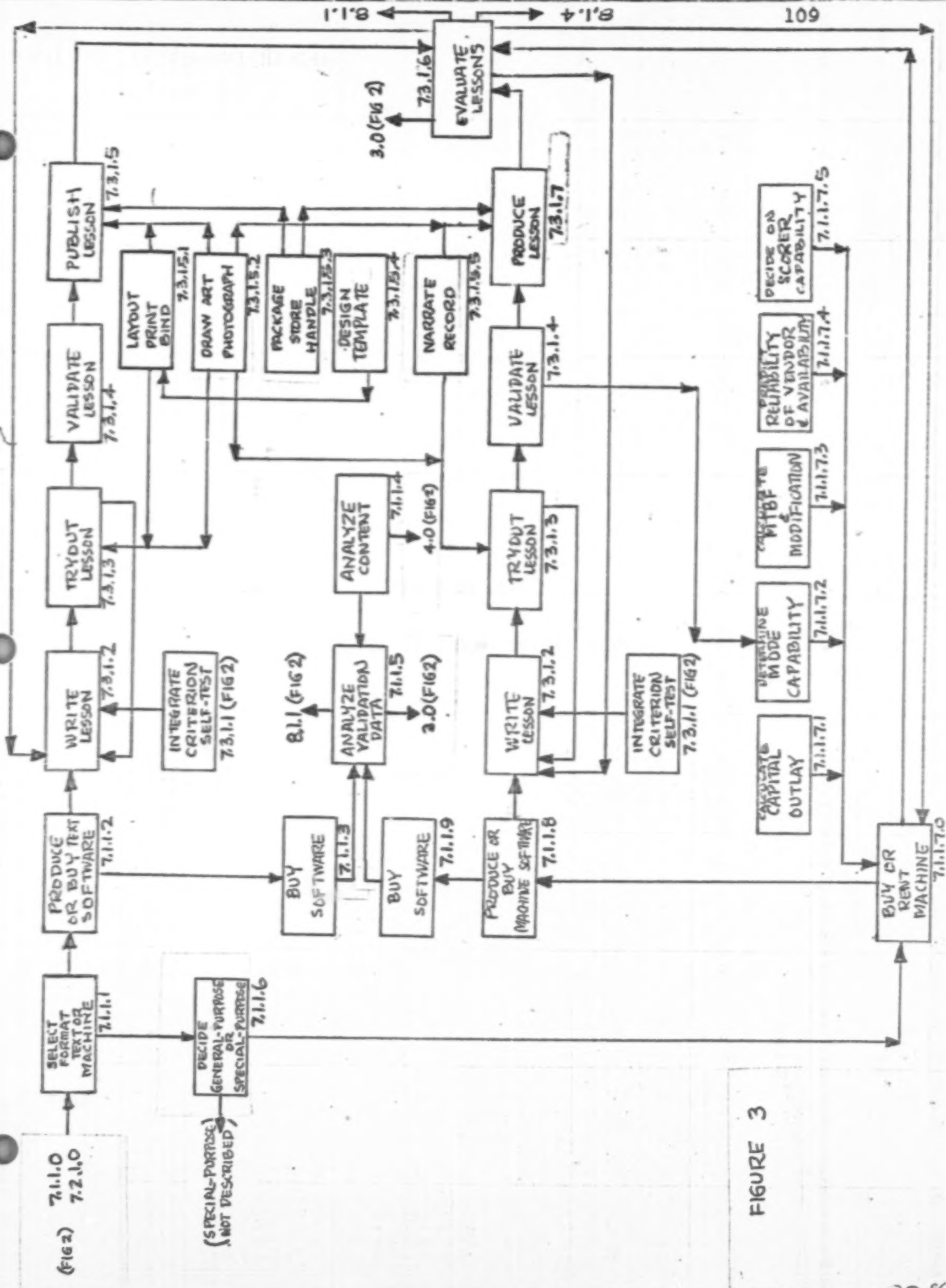


FIGURE 3

Section IV

TECHNIQUES OF AUDIO-VISUAL MEDIA

EFFECTIVE ILLUSTRATIONS FOR TEACHING

by

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Abstract

A teaching program is no better than its individual components. Effective illustrations not only enhance and augment, but should be designed as basic building blocks of the teaching program. When an author is faced with illustrating a talk at a national meeting, a consultation with an artist and photographer should be held well in advance. There are certain basic rules to follow which are necessary to produce effective illustrations.

There is much to be done in the area of liaison between the illustration sections, the authors, and audio-visual coordinators. The artists and photographers have much to offer, as they understand the possibilities and limitations of the procedures available.

When a motion picture is being considered for production, story and planning conferences are held. However, for other types of teaching aid productions such a consultation is not as likely to be the case. It may be because these aids are lower in cost, somewhat less complicated in nature and produced in a shorter time, hence it is felt that such attention is unnecessary. However, experience tells us that a much more satisfactory result is possible when a total plan is available in advance.

Oft times an author will make a request for assistance on an

exhibit of a slide series, possibly to be shown at a national meeting. Sometimes material offered by authors to serve as originals for teaching aids are quite unsatisfactory. Under the short deadlines usually existing there is no recourse to a better substitute. Had the illustrators been consulted earlier, a better, possibly less expensive result could have been obtained.

A chain is no stronger than its weakest link, and a teaching program is no better than its individual components. Effective illustrations for teaching not only enhance and augment but should be designed as basic building blocks of the teaching program. Your attention is directed to some basic and perhaps elementary rules of good illustration and the preparation and use of lantern slides. Let us observe that published illustrations frequently are reduced to approximately the size of lantern slides, hence, the same rules often apply.

Figure 1 shows three well-known phrases.

Did you immediately notice the extraneous words? Possibly not, as we tend to see what we think is important. This demonstrates that we do not always see what we look at. Authors should force the viewer to see only what they want seen.

Unnecessary data on a slide hinders the viewer, though sometimes subconsciously. Certainly it does not contribute to the effective conveyance of the message.

Figure 2 is a picture containing an image of a portion of a man's face.² It is not readily seen at first, in fact, some viewers may never make it out because of the preponderance of extraneous material.

Now with the elimination of the unnecessary elements it should become clearer (Figure 3).

So it is with many illustrations when too much is presented at one time. Possibly all of the data is pertinent but for the sake of clarity should not be presented all at once.

In illustrating an idea, an artist usually begins with a blank sheet of material and builds toward an illustration. Knowing where to stop is definitely a prime consideration. In illustrating a procedure or an object, a photographer may be confronted with a patient or a room full of apparatus. The view of the camera lens is likely to include much more than is wise to show, so his problem is one of restriction. This consideration, though very basic, is probably the most violated rule of good illustration.

In order to discuss the properties a photograph must have to make it an effective illustration, let us set up some criteria for judging it. These can be stated simply:

1. Is it necessary? Does it point out, or clarify the important facts?
2. Is it simple? Is it direct, to the point, or is it cluttered? Does it have only one central idea?
3. Is it easily read? Is it legible for those in the last row of the audience?
4. Is it photographically accurate? Are pertinent details readily seen or does the exposure, lighting, or arrangement obscure the facts?

In order to comply with the specifications mentioned, most material must be specially prepared. One never goes to the portrait studio without his hair being properly groomed and without being neatly dressed. Neither should a subject go to the illustration laboratory for its "portrait" without being properly prepared, edited, and proofread, be it even a simple drawing.

There is a great deal of existing material in published form which is reused as lantern slides or illustrations. Some illustrations are not suitable for this purpose. Remember to hold attention, most slides should be on the screen for less than a minute, thus should not contain more material than can be readily absorbed in that time.

Figure 4 might have been good as a wall chart or an illustration in a publication to be used at one's leisure, but its use as a slide cannot be very successful.

There are two main types of material presented on slides:

1. Flat copy. (Those things prepared by drawing, drafting, printing, or typing.)
2. Three dimensional objects. (Included in this group are patients, specimens, apparatus, etc.)

Among the most common in the flat copy type is the table or chart that is prepared by typing or drawing. Such tables may be satisfactorily prepared on a typewriter if a few simple rules are observed. Compactness of the copy of such an illustration is vital. This allows the letters making up the image to be larger on the slide. Ideally, they should not exceed 4 by 6 inches in size and should be printed in all capital letters. The ruling of these tables is done more smoothly and conveniently with a draftsman's ruling pen than with the typewriter. The electric machine, with its even strike and single-use plastic carbon ribbon, produces a clearer print than does a non-electric machine. A type style having no serifs on the letters is preferable. Organizations preparing such copy should consider the use of this type of machine as it also serves very well for general office use. (Figure 5)

Copy set up in extended form or letters with excessive spacing between letters, words or columns are not as legible. (Figure 6.)

The graphic illustration is more effective than a tabular one. Its message is more easily understood and remembered.

Figure 7 is a table showing the minimum height of letters which can be used in the preparation of legible lantern slides.³ Prepared as a printed illustration in a technical article it serves well, but the graphic method is superior when the information is to be used on a lantern slide.

Figure 8 is a graphic presentation which gives basically the same information as Figure 7. It indicates that a drawing made for lantern slides must be 1 mm minimum letter height for each 4 inches of its diagonal. Presented as a color slide it is more quickly read and forcefully remembered than the table on Figure 7.

All of these suggested attentions are of little value if faulty projection procedures are followed. For slides to be legible, the width of the image on the screen should be not less than one-sixth of the distance from the screen to the back row of the audience. This will provide a proper projected letter height of not less than $1/300$ of the maximum viewing distance.

Illustrations of rather ordinary or available material can be made more effective by the use of color. This can be introduced without color photography by use of diazo film material or hand tinted lithographic film. The cost can be less than that of black and white positive slides.

The second category of photographs includes patients, apparatus, specimens and radiographs. Photographs of this type should also be essential, simple, legible, and especially accurate. Lecture time is valuable. Only that part of a subject necessary to tell the story should be in the view. Additional included areas decrease the size of the pertinent feature and may also distract from it.

When one thinks of photography in connection with dental or plastic reconstructive surgery, comparisons immediately come to mind. Rightfully so, for herein lies one of the greatest values of this recording tool. We soon realize, however, that in order to be really comparative, strict conditions must be met to maintain standards by which comparison can be made. The more important considerations are size, position, lighting, and the presence of artifacts. Without considerable attention to these factors, no real comparison can be made between preoperative and postoperative photographs.

RULES FOR MAKING PATIENT PHOTOGRAPHS

1. Show the essential area only.
2. Arrange the subject in its anatomical position if possible.
3. Use a pleasing, plain background of good contrast to the subject.
4. Eliminate unnecessary instruments or other objects.
5. Illuminate the subject to delineate necessary structures well without distracting shadows.
6. Include landmarks when desirable.

RULES FOR MAKING SPECIMEN PHOTOGRAPHS

1. Properly trim, clean, drain and position the specimen.
2. Use a plain background of good contrast to the subject.
3. Photograph only the essential portion.
4. Include an inobtrusive ruler to indicate size.

RULES FOR MAKING REPRODUCTIONS OF RADIOGRAPHS

1. Choose only good, reproducible films showing vividly the desired elements.
2. Use only the necessary part of the film. Choose an area that will fit the proportion of the slide.

3. Use any arrows, lines, and lettering necessary to make your point clear.

SUMMARY

Illustrations should be essential to the discussion, simple, legible for all, and accurate in their photographic portrayal to be effective. These qualities are gained by proper selection of the subject and by limiting the areas used to only that which is essential. Good photographic technique, including correct arrangement, lighting, and truly comparative positioning, are very necessary practices.

FOOTNOTES

1. Johnson, M. L., 1956, Medical and Biological Illustration, Vol. 6, P. 17.
2. Ibid, Vol. 6, P. 17.
3. Sage, Robert, 1948, JBPA, Vol. 17, p. 73.



Figure 1



Figure 2

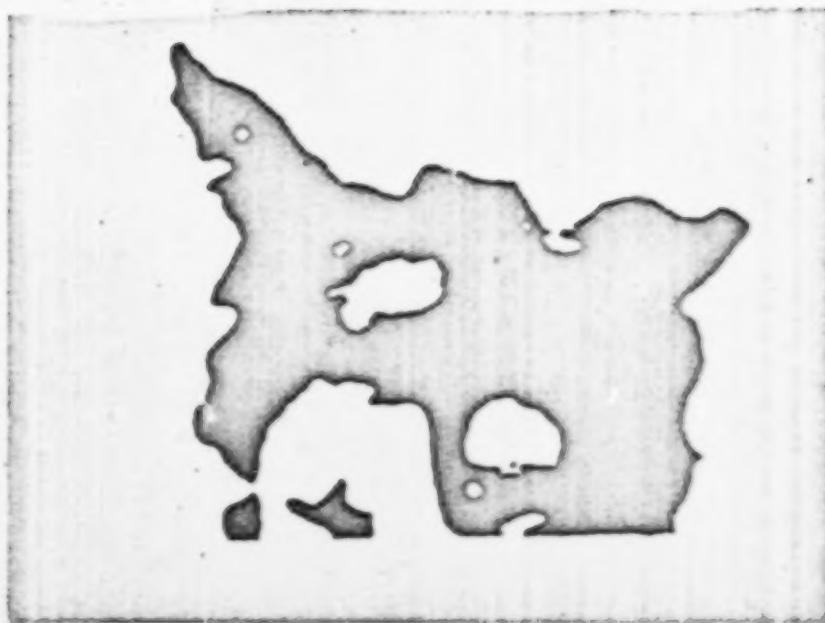


Figure 3

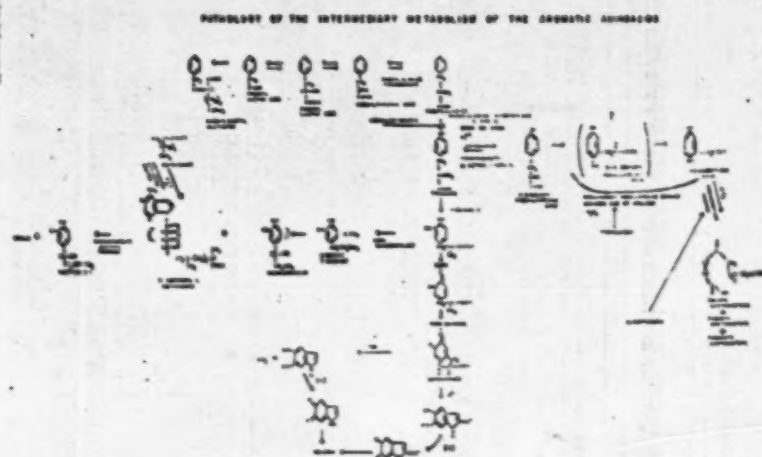


Figure 4

PRINCIPLES OF LANTERN SLIDE USE

1. IS IT NECESSARY?
2. IS IT SIMPLE?
3. IS IT EASILY READ?
4. IS IT PHOTOGRAPHICALLY ACCURATE?

Figure 5

Principles of Lantern Slide Use

1. Is it necessary?
2. Is it simple?
3. Is it easily read?
4. Is it photographically accurate?

Figure 6

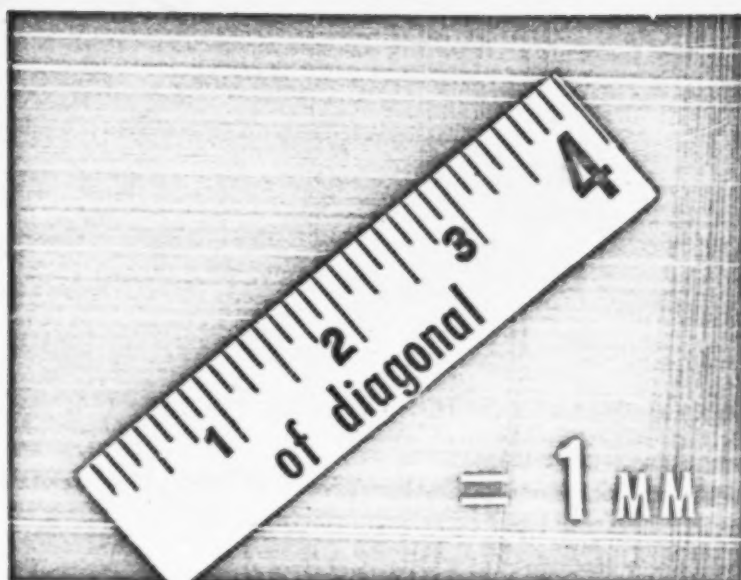


Figure 7

MINIMUM LETTER HEIGHT ON CHARTS AND GRAPHS PERMITTING LEGIBLE REDUCTION TO LANTERN SLIDES OF 3½ x 4 INCHES	
DIAGONAL OF CHART IN INCHES	LETTER HEIGHT IN MILLIMETERS
13	3.0
16	3.5
18	4.0
21	4.0
23	4.5
26	5.0
28	5.5
31	5.5
34	6.0
36	6.0
39	7.0
41	7.0
42	7.5
47	8.0

Figure 8



Figure 9



Figure 10



Figure 11

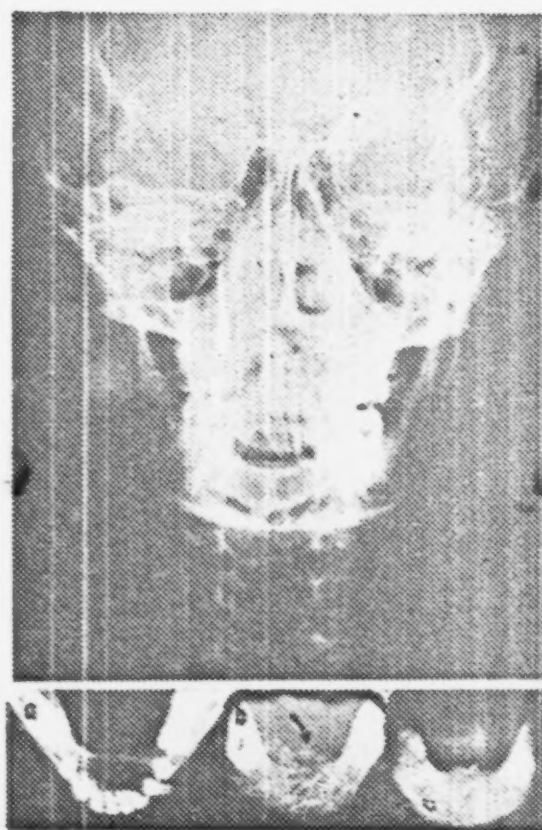


Figure 12

ART AND BIOLOGIC SCIENCE
AN ASPECT OF THE NEW ICONOGRAPHY

by

Arthur Lidov

Artist, Life Magazine

Mr. Lidov presented a pre-recorded tape-slide program on bio-illustrations. His work has recently been featured in LIFE and has received widespread acclaim.

A DISCUSSION OF MEDICAL ART AND
THE ANIMATED FILM

by

Mr. Frank Armitage, Artist and Animator
Walt Disney Productions

Abstract

A more creative approach to medical art can be found to present serious material in an accurate and exciting way. Better visual material is needed for audio-visual instruction. The animated film can be used to good advantage in the fields of embryology, genetics, neuro-anatomy, physiology, etc., to make visible that which would otherwise be invisible. The educator and professional film maker should work as a team to produce high quality educational films.

Many medical illustrators are primarily medical science men and secondly they're artists, which usually results in a dull presentation of visual material. By reversing this order a more creative approach can be found to present serious material in an accurate and exciting way.

Recently Mr. Arthur Lidov did some medical illustrations for LIFE magazine that are along the lines that I speak. To some of the conservative members of the medical profession the graphic liberties taken by the artist may not be acceptable. But remember, this was directed primarily at a lay audience. If the audience was confined to medical and dental personnel the visual material could be tailored to suit their standards, without losing graphically in any way.

I say that rules can and should be broken especially regarding the graphic arts. I do this and Arthur Lidov has done it in his work. My hope is that this kind of approach will stimulate others doing medical illustration to come up with something new in their presentations. A dynamic image is easy to remember. What is needed is better visual material for audio-visual instruction.

This is where the animated film can be put to good use. With this medium you can obtain a controlled image in motion. Think of the potential with subjects such as embryology, genetics, neuro-anatomy, hematology and physiology. It's not possible in these areas of learning to shoot live action. The student has to visualize what takes place in time, and you cannot be sure everyone is visualizing it the same. An intelligent audience may receive the same words of a very learned person, but they may get a little different mental picture, and this variation could be misleading. With the use of art work and film, the audience will all see the same image.

Some advantages of animation are the possibility of compressing or extending time and making visible that which is otherwise invisible. The emphasis of a system, dissolving on and off areas, indication of direction and related levels, to mention a few points, are all obtainable in motion, with animation.

Full animation is expensive due to the labor involved. For every frame of film there is usually a new drawing, and as the film passes through the projector at 24 frames per second, a ten minute film would require 15,000 drawings or more as there is usually more than one level in motion at a time.

Limited animation can cut the cost somewhat and can be used very effectively at times.

It is a very specialized field and to many, there seems to be a kind of magic taking place on the screen. This gives a false impression that it is easy to do, which is not so. The qualified artist involved with animation must be able to visualize the graphics in motion. This sense of timing is important to good production. The artist also must understand the mechanics of film making and then be fully acquainted with the subject that is being put on film.

This is where technical advisors are needed, and the time has come when the professional film maker and educator should work as a team to produce high quality educational films. If the educator will supply the subject matter, then the film maker will present it in a way that will retain the viewer's attention.

In the past, educational films have had a reputation for being done on a low budget to the detriment of the educator. It is important for the people in control of funds for making of educational films to realize that if they allot bigger budgets and involve professional men they will get quality films that will contribute greatly to a higher standard of education. This is no place to effect economies. A bad film is the wrong tool for the job and is a waste of effort from the time it's made.

With the introduction of the teaching machine, a new form of instruction is available. The manufacturers are developing these machines so that in the near future it will be practical to supply each student with one. But for now, use the audio-visual facilities which are available, and concentrate on producing better audio-visual materials to go in them. It's of little value to buy expensive hardware and then use second rate software in it.

Programed instruction in our schools will require new visual material in all media, whether it be slides, film strips, or motion pictures. No one method will be the answer by itself. Each media used properly in conjunction with other supporting material will contribute greatly to the process of learning.

THE ROLE OF VISUALS IN METHODS DESIGN

by

Mr. Adrian Ter Louw
Educational Consultant
Eastman Kodak Co.

Abstract

The basic problem is to increase the effectiveness of the man-audience relationship and try to solve the communications problem. The lecturer usually approaches the problem from the standpoint of the content of his lecture. Experience at the Eastman Kodak Company has shown that the "content-centered" approach is not as effective as the "audience-centered" concept. This approach identifies the audience and clearly establishes what is to be the pay off of this communication effort. When this is decided upon, a communication specialist is consulted and his backup personnel provide a single means or a variety of ways this message can most effectively be presented.

It is important, I believe, that my comments be placed in a context so that any application to your problems can be conditioned by the similarities and differences of your operating conditions and those in which the methods I plan to describe are successfully employed.

It all started a long time ago when I was conducting a series of meetings and carrying out some training programs at Kodak. I made extensive use of all types of teaching techniques and teaching materials. It appeared that these sessions were highly successful,

and so my big boss raised the question as to whether it wouldn't be desirable for more people to use these techniques. He pointed out that after all I was only human and I better plan for succession.

Also, one person couldn't handle all the work that had to be done, so the problem was how to spread the benefits of improved communication technology. This is the setting in which the plan I propose to describe has emerged.

The basic problem is to increase the effectiveness of our people in man-audience relationships. Our folks are constantly finding themselves in situations where they have to get something done by making a presentation of information or ideas to people. They have to carry out briefing sessions; they have to make reports to support decision-making and planning; they have to ask questions that give reliable responses; they have to bring about decisions. Also, they have to teach and train. These are the types of outcomes or functions of man-audience relationships whose effectiveness we want to increase.

It seems to me that the kinds of communication activity that you engage in in developing dentists are not very different, and so I am operating on the premise that perhaps some of the things we have done to increase the communication effectiveness of our people would be applicable to your problems.

Incidentally, if I were conducting this session in the facilities that we have at Rochester, we would not have to interrupt the proceedings by having to get the lights on and off and arrange to have things happen to projectors and other equipment. This would all take place automatically by pressing buttons.

Furthermore, in the rooms that we use, it would be possible for me to display all types of information to you under a condition where I could see you and you could see me, and you could do work where you are sitting. This little feature of the facilities that we provide our people we believe is a very important factor in increasing the effectiveness of their communication activities, and so although we will talk primarily about the general operating plan of producing and designing the materials, I want to make the point at this time that we do not separate the materials from the facilities required for effective use in our backup service to those who have communication problems. We consider them all part of the same service operation.

Notice that I use the term backup service. The choice of these words has special significance. The idea is that a man has a communication job facing him. There is an audience and he has to get something done through communication with them. It may be persuasion or skill development. We believe it is our function in the backup service to assist that man to plan the event so that he will be most effective and support him with materials and services to make him most efficient.

So when a man comes to this service center, we insist that he bring a communication problem. This is stated by defining the target audience and specifying what outcome or what effect is to be achieved. It has been our experience that this is sometimes difficult to achieve because there is a tendency of people faced with a communication task to concentrate at the outset on the information content of their message, and so they tend to come to us with the primary emphasis at the outset on what they want to talk about and what they want to tell them.

In other words, they are content-oriented, and the recognition of the audience is only incidental. So, one of the first things we have to do in increasing the effectiveness is to get them to identify their audience and clearly establish what is supposed to be the payoff of this communication effort. As soon as this has been done, we move on to the next phase of this initial conference and that is to characterize the audience with respect to this communication goal.

Here we ask about their status, their related background experiences, any prejudices they may have in this field. We also discuss the drives and anxieties that would reveal what they consider important. This gives us a clue to a motivation. We also analyze the vocabulary problems that we may face. Some of these problems relate to technical or precise terms. Others relate to words with an emotional overtone.

During this conference we also explore the conditions of contact. We discuss the size of the audience and the character of the meeting place and conditions under which we will meet them, and where we have complete freedom of making arrangements, we discuss what will be the ideal contact conditions.

In this discussion, the man with the communication problem supplies the specialized information about the audience and the subject. He is also responsible for the final decision with respect to the desired outcome. His associate, whom I shall refer to as Mr. B₁, brings into the transaction his wide knowledge of human behavior and his expertness in the field of communication theory and practice.

He is, however, more than a theory man, he is also familiar with the merits of the various communication techniques and media;

and he knows something about the feasibility of using these media under various circumstances. His practical side also shows up in his ability to recruit the services of specialists and direct them by reason of his ability to speak their language.

When these two men have carried out this analysis, they proceed to synthesis and here they devise a strategy for the communication job. This strategy involves a plan of action or a program of activity and also specifies the materials and services that will be required in the execution of this program. These specifications must be written so that the specific role of the media and services is clearly indicated. This is the point at which the decision is made as to whether a printed manual, a visual presentation using a live demonstration, a visual presentation using projected images, a motion picture, a television demonstration, or perhaps direct involvement of activity by the student is called for.

In some cases, a communication event may involve a combination of these media, and at times more than one may be used simultaneously. Notice that such a selection of the most appropriate medium or method is possible when the analysis of the task is made before the services of a special media are selected. It is especially important that this communication specialist (Mr. B₁) is not partial or wedded to any one particular medium.

In many institutions such a person is not available, and so the individual with a communication problem goes directly to the specialist in a particular medium, and we have no assurance that he has chosen wisely. With each of the media having its own advocates, there is a tendency for empire-building and misuse of the media.

In our operations at Kodak, we have found that the interposition of the communication specialist between the man with the communication

task and the specialist in a media is very important in our backup service. Strange as it may seem, on many occasions an analysis of the task reveals that a face-to-face presentation involving nothing more than speech unsupported by visuals is the most effective solution for the communication strategy.

In other cases, it would be proposed that a planning board or a newspaper scratch pad on which to write the responses of the audience would end up being the most effective visual. The principle behind the use of the communication specialist is that we can assume that the person with the communication task cannot possibly have enough time available to keep up with all the developments in the behavioral sciences and communication technology, and so we use the specialist as a consultant so that the latest and best knowledge in this field can be brought to bear on the communication problem.

When the analysis of the problem results in a plan which calls for materials of some kind or another, another element of the consulting team goes into action. We are calling this man Mr. B₂. It's his job to keep track of all the materials that are available and classify them in such a way that their usefulness for communication purposes can be discovered by some search system. He is able to answer the question, "Is there anything in existence that might be useful in this situation?" He also procures such material as seems to be appropriate and delivers it to Mr. A and Mr. B₁, who then evaluate it to determine whether it really is correct for the occasion.

If it is satisfactory, then the rest of the backup operation becomes quite simple, but in many cases it will be found that this material does not quite fit, so either a revision or adaptation is

necessary or a brand new production must be undertaken. At this point, a Mr. B₃ comes into the picture.

He is a specialist in the particular medium selected to do the job. In combination with Mr. A and Mr. B₁, he develops a production plan that meets the requirements, and upon its approval works with a production staff, skilled in the techniques involved in the media. In any event we are assuming that either through retrieval or procurement or through production, appropriate materials are supplied.

The final element in the backup service is that of providing the apparatus and services necessary for the use and presentation of these materials. In many cases, scheduling of the space in which the event is to take place is also carried out by this group. These operational personnel we have referred to as the C class. Some are involved in production; others in scheduling and presentation services.

The outcome of this operational procedure is that Mr. A, the man with a communication task, carries out that task with the benefit of the best communication technology, and he has done this with a minimum amount of time on his part devoted to the mechanics of this operation. We have also relieved him of the necessity of spending time and effort to keep up with this extremely complex field of communication technology.

We are assuming that he has a full-time job in maintaining his position of leadership in the field of his chosen specialty. This operating procedure just described is one that is actually in use at Kodak. Service units organized on this principle back up our personnel who are concerned with training people, instructing customers, developing a strong goods-distribution system and handling

programs of relationship with the public and the stockholders.

These services are also used during the more intimate phases of the company's operation, such as briefing, planning, and decision-making. The net result is that we believe that these backup services result in communication activities which are both more effective and more efficient, representing a sound expenditure of money for services.

I am proposing that a similar type of backup organization may be the most effective way of increasing the efficiency of a faculty. In the course of carrying out this service program, it becomes necessary for a number of people to do creative analyses of a problem and do it in such a way that they can synthesize the elements in a practical and effective program. This is done through a very simple device called a storyboard.

It's really just a big piece of plywood with strips of acetate fastened to it in such a way that cards can be tucked behind the strips. At the beginning of this planning exercise, brainstorming takes place and a card is made for every idea proposed. These ideas relate to audience characteristics, goals, audience-contact conditions and the subject under consideration. All of this is done with a visible statement of audience and goal before the group.

Because all of this material is visible and on individual cards, it is easy to see the picture as a whole and not get lost in details or controversial points of a minor nature. The strategy or plan derived from this information is, therefore, more likely to represent a thorough consideration of all important factors. When a visual is to be produced, a similar system is used. On a special card, the idea flow to be induced in the mind of the audience is plotted. This

is a recipe for a growth pattern in concepts and ideas.

Visualization is then specified by asking the question, "What shall I show again to support this readout or response in his mind?" Since each minute step in this development or flow of the continuity is on a separate card, the cards provide a basis for step-by-step visualization. There is room on these cards for notations that will guide the production staff.

When a production storyboard is complete, the validity or soundness of its organization can be tested by test-telling the story from the cards before production takes place. Planning in this way has increased the effectiveness of the visualized presentations has made it possible to produce many presentations with a limited staff, and has enabled a single production group to work on many units at one time.

I believe you can realize that such a system is a must as a backup service in serving a sizable number of clients with communication problems. It is difficult to visualize such a situation in action and also appreciate the relationship between such a group and the utilization facilities which they supply.

My best suggestion is that if you are near Rochester, drop in and take the time to see this concept in action.

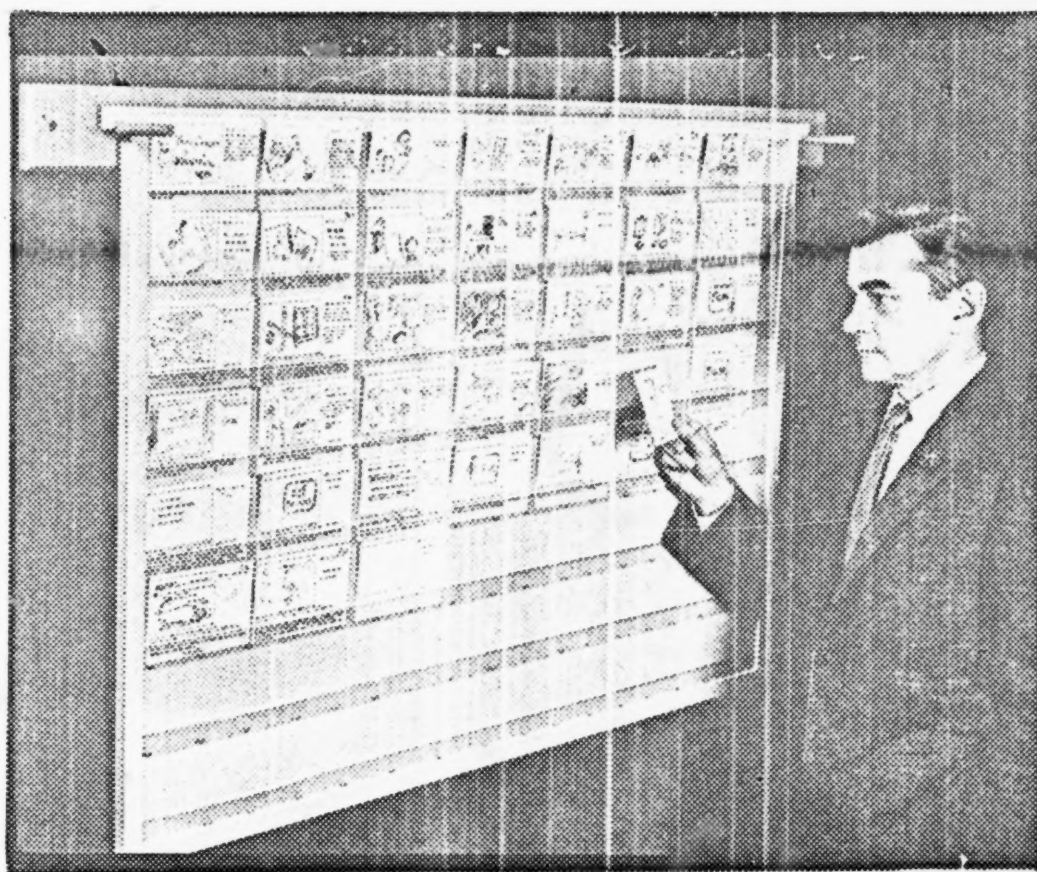


Fig. 1

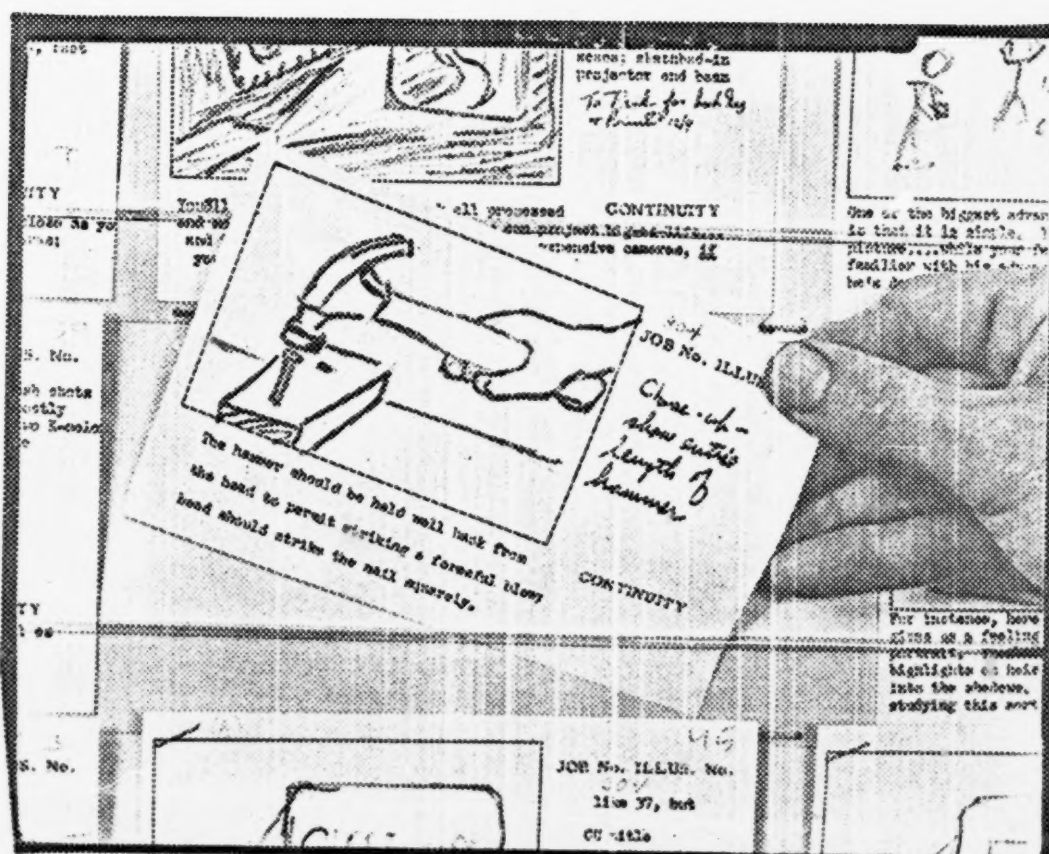


Fig. 2

THE HOLLYWOOD MUSEUM AND THE MEDICAL FILM LIBRARY

by

Mr. Sol Lesser
President of the Hollywood Museum

Abstract

The Hollywood Museum, now in the planning and development stage, will contain an electronic, automated memory device, to function as a clearing house of information on every important film and tape recording produced, including the fields of medicine and dentistry. At the touch of a button, this device will provide the location, subject matter, and how to obtain any film or tape ever produced.

It is important that I report to you specifically regarding one project in the overall program of public service by the Hollywood Museum. The International Center of the Communication Arts, motion pictures, television, radio and recording will deal in everything that is or will be hereafter on film and tape. We're planning now to establish and maintain an electronic, automated memory device, a clearing house of information as to subject matter, the location and availability of every important film and tape which will include, of course, medical and dental research studies and experiences. There the information will be stored. My friend, Dr. Barney Kully, who is now researching in this field for the museum, has opened our eyes to the vast amount of professional material now available and the tremendous value that it offers to the great professions that serve

humanity the world over. We have learned of the work of the American Medical Association film library under the inspired guidance of Dr. Ralph Creer. We have already begun preliminary discussions with him. Throughout our own country, and in every corner of the world, there are these priceless treasures on film and tape. We firmly believe that the humblest doctor or dentist as well as the great faculties and student bodies of our medical and dental colleges should have information available as to what subjects have been recorded, where the film is located and how it may be borrowed for study. For that purpose we hope to serve you and the professional world which you represent. A press of the button will bring an abstract to you. The Hollywood Museum Staff wants to be helpful in securing for your use the loan of the film to meet your needs. To reach this goal we must have the guidance and leadership of the United States Office of Education. Then to you members of the medical and dental professions, we appeal to you to inform your academies and your associations about this phase of the Hollywood Museum public service program. We need to be informed by them. We need their guidance. We must cooperate with them and we welcome their working with us. Now you can understand why I am so pleased to be here with you. You represent the life-giving service to humanity. We shall be proud to be of service to you. Are there any questions?

Q. Will there be a service charge?

A. There may be a slight service charge. If there is, it would be very slight indeed. We don't know at this time how self-supporting this Museum may be, but I think there are many ways in which we can get these films as gifts. We're working on that field also.

Q. Is it going to be tape and films?

A. Yes, tape has come into very strong prominence now. That is, not photographic tape, but the tape on which they can put the image and even the Kodak Company is going into tape as well as motion picture film.

Q. Where is the location of this museum?

A. The Museum will be on 4 1/2 acres on Highland Avenue, just opposite the Hollywood Bowl. The ground breaking is scheduled for September or October of this year.

Q. Will this project be compatible with existing systems?

A. There's a communications center at the University of Syracuse. They have a \$30,000,000 budget, \$17,000,000 has already been donated by Mr. Samuel Newhouse, and they have asked us to make our device and theirs compatible.

Q. Will the museum provide abstracts?

A. There's no provision for our museum to instruct. We leave that to the universities and to the organizations, the doctors and the scientists. It would be rather presumptuous if we motion picture and television people try to dictate the source information. The abstract would be prepared by professionals at the outset. Not professionals of the museum, but professionals from the various fields of science and medicine, etc.

Q. What is the method of contact - say if a medical school has an educational film, will they contact you for putting it in your library, or do you contact the universities?

A. That's a very good question. We are now in the cultivation and development stage of this whole program. Some of these ideas are very new to Hollywood, as you can imagine. We have largely dwelt in the dramatic picture. We are communicating as fast as

we can with authorities, and then as our institution gains public interest through publications and public relations I feel that various authoratative organizations will be contacting us.

I was out to the University of California the other day examining their device. I was shown how a surgeon in an operating room, for example, may be performing a brain operation, and if the surgeon has a problem he contacts the IBM device, for some prior experience and within moments the answer, if any, could come right back to him while he is in the operating room. About twenty different institutions are serviced at U.C.L.A. by telephone in this manner. By telephone these other sources transfer this information on to their own devices. The Hollywood Museum, I feel, will make a valuable contribution to the advancement of medical and dental education in similar fashion.

THE MOTION PICTURE INDUSTRY AND EDUCATION

THE AUDIO-VISUAL CHALLENGE

by

Mr. Gordon T. Stulberg
Vice-President Columbia Pictures Corporation

Abstract

There is a technological break-through in certain types of teaching aids presently taking place, and a fundamental change in the manner and method of teaching primary and secondary students.

Textbook publishers, educational institutions, federal, state and local governments have come to the conclusion that films should be integrated with textbook material, instead of being made on an individual spot basis.

Concurrent with this is the recent practical development of 8 mm. sound films and projectors which is revolutionizing the use of educational films in the classroom.

Graduate schools must accept and become part of this teaching medium if they are to keep pace with this revolution in education.

I thought I would take my allotted time to take you quickly, but I hope with some degree of knowledgeability, through the history of what I like to refer to as recorded image and instruction, for want of a better word. The use of the words "AV" or audio-visual education in the past several years has been somewhat of a misnomer. We don't know where it began, but it really doesn't cover what's happened in terms of the technological break throughs and the

revolution that is going on in the field of teaching through the use of recorded imagery. I think it particularly propitious that a conference at this time should be devoted to, or should involve an examination of visual aids. Whether the graduate professional schools recognize it or not, there is a technological break through in certain types of teaching aids presently taking place and a fundamental change in shift in the manner and method of teaching primary and secondary students is also taking place, and I believe the orientation and the attitudes of students towards teaching methods will be so greatly conditioned by this revolution over the next decade that it will become virtually impossible for professional schools to teach adequately unless they not only are aware of the technological revolution, but become part of it and adjust their teaching methods to take advantage of what is taking place in the elementary and secondary grades.

My company became interested in the educational film field some three years ago. We became interested because in 1961 over \$66,000,000 worth of educational films were sold. We decided to find out who was getting the \$66,000,000 that Hollywood wasn't involved with, and that led to an extensive and detailed study of the field of what is popularly called audio-visual. We found that less than 5% of all primary and secondary schools in the country have projection equipment and either purchase or rent films as curricula aids to teachers. We also found through our study of available statistics that less than 12% of all the teachers in this country were using a film, or more than one film, in an annual course of instruction as an aid to their teaching methods. We also learned that one of the primary reasons for the comparatively infrequent use

of film as a teaching tool was the cost of the equipment and the rather difficult method of utilization. For example, in the past decade the basic utilization of film as a tool in education has been with the 16 mm. sound projector. It's heavy and bulky and costs in excess of \$600. A 9 to 11 minute film, black and white or color, runs from \$130 to \$160 to purchase and keep in a library. When you think of the rather frail appearance of most of the primary and secondary school teachers in our country you can imagine their reluctance to carry a 16 mm. projector back and forth. For example, in a city as large as Boston, the teacher who is courageous enough and anxious enough to utilize film in teaching must go downtown, check out the projector weighing 40-60 lbs., put it in the car, drive back to the school, unload the projector, carry it up the stairs into the room, run it, put it back in the car, take it back downtown. You can well imagine the psychological block to the utilization of the equipment. The additional problems of amateurs threading film, which cost, as I said before, \$130 to \$160, and is subject to scratch, wear and breakage, makes it a serious budgetary problem for most of the primary and secondary schools in the country. In addition, the cost of selling and distributing educational films amounts to some 50% of the total gross sales that can be contemplated from its sale and distribution, which in turn discourages the production by those who would produce, distribute and sell films less than 11 to 13 minutes - spot films, 3 or 4 minutes in duration, films which may have a direct and primary utilization in teaching methods and instruction. During the past decade we learned that because they did it quietly and effectively and didn't disturb Hollywood with their activities, that three companies, McGraw-Hill, Encyclopaedia

Britannica Films and Coronet, were responsible for the production and distribution of more than 90% of all educational films in this country. By and large, they have done a magnificent job. What type of materials did these three companies make available to the schools? What is currently available in the primary and secondary schools? We found that up to the present, the bulk of film that has been produced was a form of spot film. Somebody decided it would be nice to do a film about the Phillipine Islands. The camera went over. Somebody wrote a sketched-out lecture, and the film was produced on the Phillipine Islands. It was then put into the McGraw-Hill Library Catalog. If a teacher in the public school was teaching geography and she came to the Phillipines and she was fortunate enough to have a 16 mm. projector in her school and fortunate to have an AV Department with money to spend on the rental or purchase of films, she would look through the McGraw-Hill Catalog. If the AV Department had purchased that film on the Phillipines, it would be available to her. Another teacher in the 4th grade may want to teach about dental care. There is an excellent film that probably is one of the oldest films that has been made. It's about 15 years old now and probably sold more prints than any film ever made for elementary schools, and it happens to be on the care of teeth for children. The film is interestingly done and is probably the most popular film utilized by teachers in elementary schools today. If this film happens to be in the library, and the teacher is talking about hygiene to a class of 7, 8 or 9 years old, she may take this film and show it to her class. Of the many thousands of films that have been made and that are currently being utilized, most of them are made on a spot basis. They are made to supplement the curricula. Generally they are not

made to fit particular curriculum requirements. It is in this particular area, plus a revolution in equipment, that the greatest changes are currently taking place and will take place in the next decade. It is in these two areas that I think you should primarily be concerned with. The emphasis today and over the next decade will be on the conversion of recorded image instructional films to the field of curriculum integration. The major textbook manufacturers, major educational institutions, the United States Government, the National Science Foundation and state and local governments have come to the conclusion that films should be integrated into text material. Films will now be made to integrate with texts and instruction so that a particular subject can not be dealt with by a teacher without the films being available in the classroom and utilized step by step with the development of the text material. One of the pioneering projects in this field sponsored by the National Science Foundation under the direction of Glen Seeborg was a three year study looking into the development and utilization of films in connection with a new set of chemistry textbooks. This study is just about completed. There are 175 schools using these films with textbooks on an experimental basis. Over 50 professors were involved during the three years in a consulting capacity, developing the films and the textbook materials together. The Louie Darouchemont Associates, for example, have been very successful recently in a new series teaching foreign languages in conjunction with text material and an 8 mm. projector to which I will refer later. Recently I had conversation with an important company in Chicago called Science Research Associates, who are revolutionizing the whole method of teaching subjects in the elementary schools. Probably the most single active force in the

public school area is Jack Cole, the Executive Vice-President. He has been attempting to determine the way in which their progressive method of teaching can be integrated with the utilization of film. Every educator I have talked to, most of the people in the government with whom we have had discussions, people who are administering the National Defense Education Act, have indicated that the future of audio-visual, the future of film is not on a spot by spot, film by film basis, but the actual integration with text material, particularly in the physical sciences, where it lends itself to its most excellent use such as botany, chemistry, physiology, zoology and anatomy. These various areas will lend themselves brilliantly to the utilization of film in a demonstrative basis along with text material. This can only be meaningful if combined with equipment that is inexpensive enough and practical enough to be utilized not by 5% of the schools and 12% of the teachers, but by 85% to 90% of the schools and teachers throughout the country. As the evolution in the utilization of film in conjunction with text material has moved along there has been a revolution in the equipment to be utilized with these films. In the last few years, and as a matter of fact, this year is a key year, we have seen the first practical demonstrations and utilization of 8 mm. sound projection. The Fairchild Corporation and Eastman Kodak Company came out two or three years ago with an 8mm. magnetic sound projector that retails at around \$400.00. It was not a self-thread nor was it a cartridge load, but it was \$200 less expensive than 16mm. projectors. Obviously the 8 mm. film used in it would be less expensive than a strip of 16 mm. film. But it was still bulky, still had to be hand threaded and therefore, it still offered certain practical impediments for use by teachers.

There are two types of sound on film, optical and magnetic. All 8 mm. sound, up until recently, has been magnetic strip.. The sound is put on a magnetic strip on the side of the film. This year the Japanese have introduced an 8 mm. projector that has both magnetic or optical sound. The advantages of optical sound are very important in the field of education because it will be one-third cheaper. The 9 to 11 minute film which presently costs \$130 to \$160 in 16 mm. with the same definition and the same clarity would cost from \$30 to \$50 for a permanent print. The 8 mm. sound projector with the same definition and clarity will sell for about \$100 to the schools instead of \$500 or \$600 which is presently the case in the 16 mm. sound projector. We're satisfied that 8 mm. sound projection is inexpensive, light weight and extremely practical to use. Combined with one additional factor which the Fairchild Corporation this year introduced in an 8 mm. sound projector is a cartridge load. You simply take the cartridge with the film title you desire and press it into the projector, flip the switch, and the entire subject in sound goes onto the screen, rewinds itself completely, and the cartridge is taken out, ready for immediate reuse. The projectionist doesn't become involved at any moment with the film in the cartridge which again means easier use by the teacher, practically no wear and tear on the film, no scratch, no cutting, and tremendous savings in cost to the educational institutions buying the film. With a considerably lower cost projector, lower cost film, lower cost of maintenance, and a tremendous break through in the utilization of film integrated with textbooks rather than a text oriented film, there will be a revolution in the next decade.

We believe that the motion picture industry with its tremendous technical competence and its enormous plant and facilities has an entirely new generation of film makers. The people who are generally associated with our business today in the executive and creative capacities are not the same people of 20 or 30 years ago. We can show you films that have come out of our industry, such as, "Rhapsody in Steel" and "The Sea Around Us", made by picture makers who have a high intellectual capacity and a positive feeling about the educational system. Many executive and creative people with excellent educational backgrounds and capacities are involved with the Hollywood motion picture industry today. They are achieving technological break throughs of their own, methods of making film more cheaply and more efficiently. This new concept in education is not just for primary and secondary schools, it is also for the universities and graduate schools. As students become acclimated and become conditioned to learning through the utilization of film and the techniques of film they will not be satisfied by an abrupt cutting off at the end of the secondary school and going into college and graduate schools where the teaching methods are traditionally by text and by oral instruction. The graduate schools must accept and become part of this new method of teaching which will involve the utilization of film and film techniques.

In the last two years I have seen the striking failure of two major academic institutions who got involved with a film series in an attempt to teach subjects without consulting people who have the creative know-how to translate product requirements onto film. A famous university in this state got an extremely large amount of money from a foundation to develop new methods of teaching English.

The films were produced over a three year period and have not seen the light of day because professors, and you will pardon my being as blunt as I am, academicians decided that they knew best how to put onto film the method of translating the academic requirements onto the screen, and it was a horrible failure. A famous Eastern Ivy League institution, fortunately not the one I attended, became involved in a new method of teaching mathematics, again under a rather large grant from the National Government. They spent several years in producing the films, then came out with a broad announcement that the films had been completed under its auspices and the schools ran, not walked away, from the utilization of these films because the teachers who looked at these films didn't understand them, much less know how to utilize them in teaching their own students.

We say that we can act as an effective, articulate and creative midwife between the Federal, State and local governments, who must eventually underwrite the research, development and technological costs of this new method and manner of teaching through the use of film. If the motion picture industry is called upon to participate in this revolution in educational films, we think that over the next 10 or 15 years this revolution, which is now taking place, will be properly guided and will be properly mature.

A SYSTEM SCIENTIST LOOKS AT MEDICAL AND DENTAL EDUCATION

by

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Abstract

"System" design of an educational program for medicine and dentistry requires a statement of functions that must be performed if the program is to meet its objectives. Such a statement of functions for a program under design at the System Development Corporation is:

1. Recognition and Evaluation of Needs for Training
2. Establishment of Training Priorities
3. Course Development and Redevelopment
4. Training of Instructors
5. Conducting of Training and Testing
6. Evaluation of Training

Some very desirable features that can be incorporated in an educational program are unique results of system design and cannot be easily or cheaply retrofitted.

Another feature of system design is the planning to take advantage of new techniques and hardware that will be available at the time the system is installed. An example of a computer-aided sketching program was shown.

A SYSTEM SCIENTIST LOOKS AT DENTAL AND MEDICAL EDUCATION

INTRODUCTION

This paper is a report of selected information about information processing systems for education and training in medicine and dentistry. Information was selected from materials gathered and generated partly during a joint study of the Department of Medicine and Surgery of the Veterans Administration by the VA and the System Development Corporation, and partly through SDC's continuing interest in the application of techniques of system analysis to solution of problems of education and training in biomedical systems.

Four topics are discussed briefly: 1) Two techniques of system design that are of general interest to educators for gaining insight into their problems; 2) Functional representation of an information system for education; 3) An example of user needs in an information processing system for education in the health sciences; 4) New equipment and techniques.

SYSTEM DESIGN FOR EDUCATION AND TRAINING

Two activities important in the design of an information processing system but generally useful for the insight they give as a way of looking at a system are 1) identification and description of needs of present and future users of the system, and 2) determination of functions a given system must perform to fulfill its mission.

When the design of an information system includes radically new or different techniques of information processing, it is almost impossible to gauge the needs of future users of the system. When faster, high capacity, and better designed processing systems become available, professional users change their behavior as they learn better ways of operating within the new system. Behavior changes

place new demands on the information system. These demands cannot generally be anticipated before the system is put into operation because they evolve as a result of continuing interaction of the user with the system.

Some changes can be anticipated from a study of user needs generated by intermediate implementation of a portion of subsystem of the larger system. This information subsystem might be implemented to run in parallel with the existing system rather than to actually carry part of an on-going operation. An "intermediate" system differs in many ways from "final" system design. Intermediate equipment will probably be whatever is convenient, available, or can be arranged and not what would be specified for an operating system. Many functions to be performed by machine in the operating system may be performed by men in an intermediate implementation. Although "running" the operation with the existing information system, personnel will be very much aware of new information or different assemblies of information required for and processed by the parallel intermediate system. Reports generated by the intermediate system can provide information not available in the existing system and will be useful to personnel. As this new information is used in on-going work and as interaction with the intermediate system increases, demands for information from the intermediate system and evaluation of information generated therein will provide indications of new user needs.

Not all potential needs can be anticipated, however, so no designed configuration of men, machines, and operating programs should be thought of as truly "final". Rather, provision for on-going evaluation of system performance and consequent system

modification must be a part of system design. Preferably, some members of the original design team should be actively involved in updating an operating system.

The second design activity of general use is determination of functions a given system must perform to fulfill its mission. Persons responsible for finding solutions to acute problems of overcrowded classes, understaffed faculties, and antediluvian courses may be too harried to find time to contemplate the act of teaching in its larger context as only one of several functions that must be performed. It is just as important, however, for "fire-fighters" as for designers to take an overall or system point of view. Persons solving immediate problems must make decisions about which difficulties to tackle first, which alternative solutions to implement, which compromises to accept, etc. Guidance in making these decisions may be obtained from considering which courses of action would facilitate or would bring existing activities more closely into coincidence with the design of the ultimately desired system.

As an example of what is meant by a functional description of an information processing system for education and training, consider the following functional diagrams developed during preliminary design considerations of the SDC/VA study.

FUNCTIONAL REPRESENTATION OF INFORMATION PROCESSING SYSTEM FOR EDUCATION

The educational mission of the VA Department of Medicine and Surgery is to provide facilities and opportunity for all employees to receive training they need to perform their jobs effectively, to train students into professional men, to provide continuing education to postgraduate professional employees, and to train veteran

patients and their families for the continued health care of the veteran.

What functions must be performed and what information must flow through the system if this mission is to be fulfilled? Six different functions are described below. They are represented as "boxes" into which information flows and from which processed information is fed into other system activities.

The first function is "recognition and evaluation of need for training". Information, indicated by arrows, flows into the cognizance of persons and/or machines that perform this function. Sources are: 1) professional schools that set training requirements and training standards for students, i.e., clinical clerks, medical interns and residents, nurses, occupational therapists, physical therapists, dietetic interns, etc.; 2) personnel and management groups that produce directives governing training; 3) individual employees who desire training; 4) physicians who prescribe training for patients or their families; and finally, 5) reference libraries that may be queried for information required to perform the function. Out of this function flows processed information in the form of validated training needs, passed on to the function that establishes training priorities; and staffing needs, passed on to management.

A diagram of the process is given below.

Management Function	(Directives)			
Personnel Function	(Directives)			
Individual Employees	(Requirement for Training)	Need Recognition and Evaluation	(Validated Training Needs)	Training Priority Estimates
Patient Care Function	(Requirement for Training Patient, Family)			Manager Function
Experience, Medical Schools, Universities, Professional Associations	(Requirement for Training Standards)			

Information flow into and out of the five remaining functions is diagrammed below. These functions are: establishment of training priorities, course development and redevelopment, training of instructors, conduct of training and testing, and finally, evaluation of training. From this function information is fed back into the first -- need recognition and evaluation -- thus closing the information loop. (See pages 158 and 159)

At the level of generality of this statement of functions, the description could apply to many quite different training programs. The uniqueness of a specific system appears on the flow diagram as the designer expresses in greater detail the information that flows through the system, and as he structures the functions into sub-functions. Uniqueness is determined largely by the needs of users of the system. A somewhat more detailed example as such a "user need" is given below by way of illustration.

EXAMPLE OF USER'S NEED IN AN INFORMATION PROCESSING SYSTEM FOR
EDUCATION IN MEDICINE

Training of medical residents is now carried on largely as a preceptorship and varies widely from institution to institution. Medical educators would prefer to have enough information about the dynamics of how men learn about disease to be able to structure a more nearly uniform approach to residency training. Existing methods of information processing for medical education do not provide information about how residents, or for that matter, how practicing physicians learn about disease. Here is a user's need that is not met by the existing system. Can we design a system to meet it? The following brief sketch outlines a system of information processing for patient care, medical research, and post-graduate medical education that could meet this specific need.(pp.158 & 159)

In a hospital or medical agency with an integrated information processing system, the three major medical activities: patient care, medical research, and medication education are linked by a common information system. A patient is admitted to this hospital by an admitting physician who is aware of the interests of clinical researchers. If the admitting diagnosis indicates that the patient's history and medical record may be of importance to research, research is notified of the admission. In return the admitting physician may be requested to include additional tests for the patient before he is given any medication. Once the patient is on the ward and his active medical record is kept in a computer-based information system, research will have access to the record and can follow his progress without making special requests for information that would put an additional burden on the attending physician and

Need Recognition and Evaluation	(Validated) (Training Needs)	Training Priority Establishment	(Excess Demands) (Training Schedule) (Training Schedule)	Management Function Training Activities Experience, Medical Schools, Universities, Training Schools
Need Recognition and Evaluation	(Validated) (Training Needs)		(Training (Requirements (for (Instructors	Train Instructors
Experience (Universe)	(Teaching) (Materials)		(Job Description) (Trainers)	Personnel Function
Employees' Plant Equipment and Supplies	(Resource) (Availability)	Course Development and Redevelopment	(Criteria for) (Evaluating) (Courses)	Evaluate Training
Evaluation Training	(Need) (Recognition)		(Requirement) (Equipment) (and Supplies)	Logistics Function

Employee Files	(Current Status)		Employee
Course Development and Redevelopment	(Training Requirements (for Instructors))	Train Instructors	Employee
Logistics Function	(Training Materials)	(Change in Status) ((((Training Log)	Conduct Training and Testing
Training Activities	(Training Protocol)	(Training Log)	Training Activities
Logistics Function	(Training Materials)	(Training Reports) (((Change in Status) (Training Reports)	Personnel Function
Employee Files	(Current Status)		Employee Files
Conduct Training and Testing	(Training Reports)	(Findings)	Evaluating Training
Personnel Function	(Post-Training Performance Evaluation)	((((Need Recognition)	Need Recognition and Evaluation
Course Development and Redevelopment	(Criteria for Evaluating Courses)		Course Development and Redevelopment

nurse. If, during the course of the patient's hospitalization, other tests not requested by the attending physician would yield information of importance to research, these tests can be requested by research and will be performed upon the okay of the attending physician.

Such a tie-in between clinician and researcher cannot only keep the clinician abreast of research activities, it can also keep the medical record as current as possible with medical advances, thus improving the record for use as a teaching instrument. Once these excellent records are stored in an automated information system, they become easily available for use in teaching. In this information system a computer has been programed to serve as a "teaching machine" for residents and staff. In addition to having standard, if I may stretch a point, teaching programs, this computer is equipped with a series of adaptive programs that will scan the patients' records, comments and questions from students and staff, errors and correct diagnoses, and any other information provided. Adaptive programs will sort, compare, contrast, and in general "digest" this information, adding the results to its memory store. After a period of collecting and evaluating information about the reaction of students and staff to patients' changes in condition and responses to therapy, the teaching computer will be able to supply information about how men learn about disease.

NEW EQUIPMENT AND NEW TECHNIQUES FOR INFORMATION SYSTEMS

The success of this system depends heavily on the ability to write adaptive programs to provide the computer with a means of evaluating and comparing information that is gathered in very different formats, with different factors of reliability and

creditability. Techniques for writing such programs are now being developed and tested under the name of "artificial intelligence" or "adaptive programs". Frequently, the success of an information system in meeting the user's needs may depend heavily on new techniques of programming, new hardware, or both. The system designer and system modifier must keep abreast of the state of the art in these two areas. Because a long period of time often elapses between the beginning of a system's design and its implementation, a designer may well design for the use of hardware or techniques that are still "experimental" during the initial stages of the design.

What are some of the other techniques that fall into this "experimental" category and that hold promise for future information systems for medical and dental education? There are adaptive techniques that allow one to write or draw on the screen of a cathode ray tube as a means of entering data or words into the computer. A computer can alter and improve what appears on the screen according to the instructions of the writer: casual drawings can be "squared up" automatically, scale of drawings can be changed, proper perspective of a two-dimensional representation of a cube can be maintained automatically as the orientation of the cube is changed, words or phrases can be "erased" or moved around for purposes such as editing copy. Also under development are new languages that will allow one to browse through collections of information or to process information incrementally. That is, all the data do not have to be at hand for processing to begin. You proceed with what you do know, and the same program can be used later to continue processing when more data or information have been acquired.

Voice-addressed computers are in use experimentally, portable computers are under test that would permit "bedside" use of a computer to which a patient is directly linked, consoles and programs have been developed to allow a computer to handle mathematical functions as it normally handles numbers.

Perhaps in this region of new developments there exists the solution to a problem now troubling you. Whatever your responsibilities in the design or modification of educational programs, take advantage of the system approach to gain new insights into your problems and their solutions.

THE TECHNOLOGICAL REVOLUTION IN EDUCATION

by

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Abstract

This revolution involves the organizing and arrangement of men, materials and machines to solve our educational problems.

The classroom facilities of 1925 consisted of a blackboard, textbooks, inkwell, paper, possibly a lantern slide projector, and a picture of George Washington.

Many developments since then have been added, such as 16 mm sound projectors, filmstrips, slides, tape recorders, long play records, language laboratories, bookmobiles, closed circuit television, teaching machines and programmed learning. This arsenal of tools is available to aid the teacher in communication.

At this conference you have been concentrating at a level comparable to a scientist looking through a microscope; that is, in emphasizing programmed learning, you have been looking at an educational process which is highly detailed in nature and which is subject to analysis and very rigorous research. I am going to reverse this process, so to speak, and get up on a Telstar satellite to take a look at the over-all impact of technology on education. What you are doing with this high degree of analysis inherent in programing, in essence, is to contribute to a larger movement--a technological revolution in education.

Technology, in the final analysis, is a way of looking at life and a way of solving problems. Technically, it's a way of organizing and arranging materials and men and machines to solve problems in terms of the most feasible solution.

Essentially, insofar as you have been concerned with programing you have been dealing with what is possibly the most highly developed phase of technology applied to instruction. I think there are one or two others, but the editor of the JOURNAL OF THE AMERICAN ASSOCIATION FOR THE ADVANCE OF SCIENCE says that programing is the second technological revolution in education, printing being the first. I don't believe this is a completely accurate description, but you can make a fairly good case that the development of teaching machines and programmed learning is a large part of a technological revolution just beginning in education.

It is important to remember that a technological culture thinks differently about all of its problems than other cultures. This form of thinking arises naturally within the technological process. To assess this thinking within education as it is developing, let us briefly take the long look instead of the microscopic look. What has been happening to the teaching process under the control of the American school teacher or the college professor over the last few decades as this push toward technology has developed?

The American school teacher in 1925 had at her disposal a fairly good technology of textbooks. Don't forget that the graded readers using techniques like the Thorndike word count, which is a technological approach, were introduced into American education about 1925. The testing movement, another technology, was just getting started. But in the teaching process itself, the American school teacher had a classroom with a blackboard in it, a picture of

of George Washington, a bust of Beethoven, and, if she had an artistic temperament, a vase with a few flowers. One might say--if you don't count such things as laboratories--that the professor had even less.

There was, of course, some scientific apparatus, but practically no tools based on modern means of communication. Around 1890 the standard lantern slide and the so-called magic lantern (opaque) projector were available but not widely used. The Keystone "600 Set" of slides dated from about 1900 and was quite highly programed for those days. The producers had broken lessons down and illustrated them, but only a few school districts had this type of material.

We continued to teach school with George Washington's picture and so on until the middle Thirties. All of a sudden during this period a kind of first-stage boost occurred in the technological culture which education was about to become. Beginning in 1925, the 16 mm silent motion picture projector gained some approval in American education, and by the middle Thirties these projectors had become available at a relatively low price. About 1936 the 16 mm sound motion picture projector appeared upon the educational scene. This development had a great influence on the way people thought about instruction. During a short period of about six years the Rockefeller Foundation, the Payne Fund, and the Carnegie Foundation put quite a lot of money into research and development, principally in radio and motion pictures. The National Academy of Sciences established a Committee on Scientific Aids to Learning which was, for example, supported for four years by the Carnegie Foundation.

Another factor here was a social and economic one--the depression. Educationally, we had the CCC, the NYA, the WPA, all engaged

in trying new educational solutions to problems. For example, the WPA had model shops all over the country, preparing materials for school use--tooling up, so to speak, our educational culture. The elements of invention of new devices, money for research and development, and a greatly changed social situation coincided with other events to force technological changes.*

When the war came the Armed Forces took off with what knowledge was available concerning instructional technology and added some new items, implemented with money and people. A tremendous training job was done--and it was a technological job.

At the end of World War II, with education having marked time, we had again a period of social upset, a new world. We wanted to make the world safe for peace and democracy. We were going to do things in new ways. And we had inventions, such as the wire recorder, the tape recorder, and the long-playing record that became available shortly after the war.

One of the greatest selling features of the day was a short article in The Reader's Digest called, "Can The Schools Teach the G. I. Way?", which meant, can the schools use motion pictures, film strips, recordings, etc., in teaching as the Army, Navy and Air Force did? Superintendents of schools and boards of trustees for the first time became interested in supplying the American school and college with an arsenal of tools in a large way. In other words, we were moving from a chipped flint culture to a metal hand tool stage during this period.

In the middle Fifties the educational system was by no means

* We should not forget, in all of this, the gradual accumulation of knowledge in education and psychology. The work of W. W. Charters, Sidney Pressey and Ralph Tyler is an example.

saturated with equipment, but, even so, the amount of equipment manufactured began to level off. Materials, such as films and filmstrips, however, continued to increase. Then the same cycle started all over again.

First of all, we began to have greatly increased competition with Russia. In 1957, the Sputnik Era began. For the first time, an educational race with another country entered our thinking. Principally for other reasons, the Ford Foundation entered the educational picture and poured money into research, development, and, primarily, demonstration in order to hasten the widespread adoption of technological means to solve educational problems. In addition, Armed Forces research money for human factors and training work also created some valuable educational fallout. The Ford money was mainly directed to one new invention--television. The Armed Forces were able to share information developed from research in television and films used in instruction and, in a development that lay dormant for a few years, from research related to teaching machines and programmed learning.

The decade, 1955-1965, can be viewed as having again a collection of factors--a socially restive situation, invention and money for research, development and capital outlay--which characterized the two other periods providing relatively high energy boosts in the direction of an overall instructional technology. The forces behind this last effort are, of course, much greater. As a culmination, the passage of the National Defense Education Act by the U. S. Congress in 1958 not only pointed the direction toward a widespread technology of instruction, it provided money as a motive power.

This decade, 1955-1965, is probably a true transition decade which marks the period of the beginning of a full-scale technological revolution in education. The beginning of the decade had the excitement of television, which was closely followed by the less exciting but persuasive language laboratory. Lest anyone think the language laboratory is a minor event in American education, let him realize that there are now about 10,000 installations in the schools and colleges of this country, probably purchased at an average cost of over \$10,000 a piece. The greatest interest, however, came in the middle years with the advent of teaching machines and programmed instruction. The idea of a machine that would "teach" and, slightly later, the realization that programs could be created that would teach caught the public fancy and flowed through the popular press. Many people, including some educators, still think that instructional technology begins and ends with this development.

There is no doubt that, through programmed learning and its concomitant ideas of stated behaviorial objectives and deliberate shaping of behavior, a powerful tool has been placed in the hands of teachers. However, this is not the end. The transition, in fact, is just beginning. The present growing flood of programmed textbooks and the deemphasis in certain quarters of the teaching machine is only a minor phase. Teaching machines will be developed using audio-visual means of presenting stimuli which books cannot do. Books will be used for what they can do; machines, for which we do not even have good prototypes, will be provided for other tasks.

We are developing right now some other interesting technological approaches to instruction. First, there is an upsurge in conventional audio-visual devices and materials, particularly the

overhead projector. Then the development of sound for 8 mm film opens a host of possibilities when combined with cartridge-loading individual view boxes, inexpensive production and new cartridge-loading or slot-loading projectors. At the other end of the scale, various means are being devised for complicated presentations to large groups. These include multiple imaging devices such as those created by Teleprompter and multi-screen techniques now being experimented with at Eastman Kodak and elsewhere.

Various forms of classroom communicators, allowing an instructor to obtain feedback by electronic means from individuals in a large group, will appear next on the scene, as will inexpensive test scoring machines. Finally, the decade will end with some of the present experiments with computers as teaching machines moving over into field testing and on toward more general application.

Beyond 1955, the picture is not so clear, but certain trends can be noted. We are moving into the era of instructional systems, in which many of these technological developments, viewed now as simple black boxes, will be put together in whole systems of instruction. Thus programmed learning, performance aids, groups of paper back books, conventional audio-visual materials, television, 8 mm film, large group multi-media presentations reinforced with classroom communication devices may all be fitted together in different and planned patterns determined by the objectives, nature of the students to be served, qualifications of the teachers, materials and creative personnel available, etc. Eventually, we may well end up with computer controlled instructional systems. The possibilities are immense. My only suggestion to medical and dental

educators is to stay informed; as in your own substantive fields of medicine and dentistry, each day we can, in this field of instructional technology, all become a little more ignorant as knowledge continues to increase.

UNITED STATES DEPARTMENT OF AGRICULTURE

Office of the Director
Washington, D. C.
February 1, 1944

The following report was submitted to the Director of the United States Department of Agriculture, Office of the Director, Washington, D. C., on January 28, 1944, by the Director of the Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C.

Section VI

STUDY SESSION REPORTS

The following report was submitted to the Director of the United States Department of Agriculture, Office of the Director, Washington, D. C., on January 28, 1944, by the Director of the Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C.

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STUDY SESSION ON PROGRAMED INSTRUCTION

by

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When most people think of programed instruction, they picture a book of an odd sort--an interminable sequence of short sentences, none of which are complete. They know that the student confronted with this odd book is supposed to write something down and, immediately after doing so, he will be told whether he is right or wrong, usually by being shown what he should have written. Advocates of the "other school of programing" have a slightly different percept--this time, of a book no less odd consisting of pages of text which are not read in the order in which they are printed. The student confronted with this odd book is supposed to read a page, choose an answer to a multiple-choice question, and turn to a page keyed to the answer he chose. If he chose incorrectly, he gets more material to read and, usually, another try at the question. Advocates of machine teaching, of course, see these materials, not as books, but as text projected onto a screen or seen through a window in a box-like device which reduces the chance to "cheat". As long as programed instruction is thought of within the context of presentation of verbal material by whatever means text can be presented, it does indeed belong among the "media of instruction".

The idea behind programed instruction is more powerful and more pervasive than that. Programed instruction is a methodology, not a medium. It is a methodology which was, in its early history, restricted to one medium, but which is, I believe, breaking out of

these limits. Some of its ideas are not new. Others, even if said before, are still revolutionary in education.

A program is a reproducible sequence of instructional events which produce a measurable effect on the behavior of the student, of each student. This simple definition includes some old ideas and some new ideas. (Some aspects of the popular conception of programs are not included.) It does not specify what the medium is that presents the specifiable sequence of events. It does specify that, no matter what the medium, it is not an acceptable instructional sequence unless it can be shown to produce the results it has set out to produce.

How revolutionary the idea of quality control in education is may be easily demonstrated by examining the attitudes of almost all teachers toward their own effectiveness. A brilliant lecture is defined by its impressiveness to colleagues who can appreciate its artistry, not by its effects on students who may not only be unable to see why it is brilliant, but indeed may have failed to acquire even lesser behaviors from it. Teachers are understandably proud of those students whose behaviors they have influenced--and who usually are given A's for their ability to keep up with the teacher. The C's and D's, however, are lazy, poorly endowed, or at least not working up to their capacity. Whatever the reason for the failure of these latter students, it is seldom laid to poor teaching techniques.

The idea of a major industrial concern turning out with a standardized production line 10% superior products, 20% good products, and 50% average products, with the rest classed as disposable, is so ludicrous in this age of modern technology that it would hardly bear

mentioning were it not for the obvious parallel between this outlandish image and the present situation in education. As long as there were enough A students to fill the needs of the community, the necessity of forcing D students to do A work did not arise. There is no need to repeat to this audience the reasons for the sudden emphasis on quantity as well as quality of educational products, i.e., trained minds. While any method of production must fail in some cases, the teaching techniques of our pre-technological instructional culture are failing in too many cases. Conferences such as this one indicate that the interest in improved techniques is growing.

There are two sources of improvement, one of which has been well represented here. This is the full employment of the technology, and artistry, available to get materials in optimum form to the students. Every effort is being made to present the best, as this best is seen by the "text-lecture" culture of present-day education. The one thing that seems to be lacking is what might be called the pin-point feedback to the instructor inherent in the behavioral technology from which the concept of programmed instruction sprang. In a broad sense, it is time to know that what is done well does well. Programed instruction in the narrow sense of the little booklets with holes in them has rarely been done well, but its practitioners are developing insights into the problem of what does well.

A program begins with a clear statement of objectives, accompanied by a test which purports to measure the objectives, and a statement of what will be considered adequate performance. Setting up of this goal is not easy. Teachers who are used to defining their courses under such terms as "familiarity with" or "appreciation

of" the subject find this gives them little help in constructing test items. Test constructors long used to evaluating test items on the basis of whether such items discriminate between good students and poor students find that the construction of items that discriminate between good teaching and poor teaching is a new task.

Several discussions in the study session on programmed instruction centered around the problems of goal-setting. It was noted, quite accurately, that a teaching technique which produces mastery may also produce aversion to the subject. If continuing interest in the subject is a goal of instruction, and it should be, then this objective must be stated and measured. (For most well-socialized students, asking if they liked the course is not a sufficient measure. A "test item" in this area may require patient observation over a year or two.) Predicated on the position that there will always be a difference in the amount learned, objections were raised to the notion that all students should be given A's. This is a valid objection. The concept of a program which produces a reliable amount of learning from each student does not preclude extra benefits to a few students. At the present the common procedure is the design of a test which measures the minimum acceptable level of performance below which the teacher can be said to have failed to teach effectively. This is a test of the program of the teaching techniques used, and not of the students. The decision to add items which would discriminate between students should certainly be allowed to any programmer as long as such items do not interfere with measurement of the effect of the program.

Once the goals are set, the process of construction begins. If programmed instruction is to behave like a methodology and break

out of the bonds of the verbal straitjacket it has been in, experts from the spectrum of communication arts should be employed. This is not to say that the written word is not the correct tool for many kinds of instruction. It is and will remain so. The use of complicated machinery to display what a book page can display is hardly technology. A film presenting one suffering can motivate as no lecture or text can in inducing students to learn survival procedures. Technology implies using the tools that will do the job.

It is in the next stage of production that the clear contribution of the new methodology appears. This is the testing and revision stage. All experienced programmers advise the testing of the first draft on a single student. I prefer a bright student with at least mild aggressions towards teachers. A slow student cannot see the ambiguities and oversights, and a pleasant student will agree to everything the programmer does. The person who deals with this student must be a shrewd observer of behavior, a clever interrogator, and enough of a subject matter expert to write the missing frames or rewrite the inadequate frames on the spot. He must observe his own behavior equally as carefully. Too many ego-involved programmers conveniently forget the amount of teaching they themselves have done in these initial sessions and fail to make the revisions dictated. Without the tutor present, however, confusions which arise in early sections of the material being tested invalidate the results on later sections. Whether the presentation be on film, in a programmed text, or any other, the data that are needed at this stage are literally frame by frame, picture by picture, sentence by sentence. There are no substitutes for it.

Advice on how many of these tutorial sessions are necessary is difficult to give and there have, therefore, been many guesses.

The only clear stopping point is an effective program. (More efficient and more artistic ways to get the same results may occur to programmers as the initial approach nears perfection. For those on research grants, this is the next path to follow; for those with a job to do, it may not be possible to start over.) There is a point, however, at which the program must operate on its own, without the programmer. This is the point at which real validation studies begin. A real validation study must involve a pretest, control over the students' procedures in taking the program and, hopefully, control over other influences that might invalidate the test, such as outside instruction. If under these controlled conditions the program produces the results it set out to produce, it is ready for broad field testing.

This procedure is not new in this world, although it seems new to many producers of educational materials. No airplane manufacturer would build a hundred planes straight from the first drafting board and send them aloft to see if 90% of them will fly. Wind tunnels and stress tests save a lot of pilots. On the other hand, no amount of factory testing will guarantee perfection in daily use. The same principle applies in the development of a program. New observations in the field will reveal areas of difficulty which have not been seen in the laboratory. But 100 students in the classroom cannot replace that first individual student. Indeed they need not. Why punish 100 when one will tell you most of the major faults in the design?

The research described above is time-consuming and expensive, but it is the sine qua non of programing. Until it has been completed, comparisons between the program and other teaching techniques

are, at best, inconclusive. There is a legitimate reason for comparative studies of the sort presented at this conference, a reason which was discussed in the study session. Since time, talent, and money are involved in the production of a program, it is often necessary to demonstrate to those who make financial decisions that the method is worth supporting. A difficulty arises, however, in generalizing from the results of such demonstration experiments. If the experimenter is fortunate in his choice of a program, the results may seem to indicate that programmed instruction has possibilities, while an unfortunate choice of program will seem to cast doubt on the method. In both cases, however, the experimenter has tested only one instrument, one program. "Conclusions from an evaluative study of a single instrument apply only to that particular instrument, and the generalization of the results to other instruments of the media it represents have, at most, the status of untested hypotheses."¹ An analogy can be offered of a person who will never touch another lobster because of an unfortunate first experience with one in a poor restaurant. In many early studies of programmed instruction, such overgeneralizations from insufficiently developed programs were heard from disappointed users, and conversely, the success of one or two programs cast a "halo-effect" over all objects labeled as programs and seeming to resemble them.

In an interim report, the Joint Committee on Programed Instruction and Teaching Machines (American Educational Research Association, American Psychological Association, and Department of Audiovisual Instruction of the NEA) stated: "Experimentation conducted thus far

¹ Lumdaine, A. A. "Instruments and Media of Instruction." In Gage, N. L., (ed.) Handbook of Research on Teaching. Chicago: Rand McNally & Co.

supports the expectation that good programs, carefully developed, can significantly improve both the quality and economy of instruction. Whether any particular program will do so is subject to question until established by adequate tests of that program."² It is the feeling of many people in the field that the time has passed in which programing had to prove itself. It is now time to devote research efforts to either the development of specific programs that do what they set out to do (the type of research described earlier) or to the development of the basic technology. It would appear that the former is more **germaine** to the interests and needs of the medical and dental schools, while the latter might be left to the "basic scientists" who have no immediate involvement in the solution of pressing educational problems.

The study session concluded, on a more practical note, that cooperation between universities would be advantageous and some central source of information was needed from which individual schools could learn what was available, what was being developed, and what had not yet been tackled. Since the development of a program is a sizeable task, duplication of effort is a waste of time and talent. There was general agreement that financial support was necessary, but sources are less easy to identify. Several foundations, among them the Carnegie Corporation and the Fund for the Advancement of Education, have been receptive to developmental proposals in the past. Universities, themselves, may wish to sponsor program development once the necessary individuals are convinced that investment in the improvement of teaching is a valid function for university budgets.

² "Criteria for Assessing Programed Instructional Materials." Audiovisual Instruction, 8, Feb. 1963.

STUDY SESSION
ON CLOSED-CIRCUIT TELEVISION

by

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This group met in a section of the Human Factors Laboratory which was being used as a TV origination area. As a result of a discussion of approximately two hours, the following statements can be made:

1. Like all other media, there are some things TV can do for the dental education process, and some things it cannot do. Here are some of the things only TV can do:

a. Immediate image magnification. Although there are other tools which will magnify an image, only TV can do this with spontaneity. Not only is this useful in many obvious ways such as the demonstration of procedures, the observation of clinical material, etc., but it will also allow us to effect some changes in conventional teaching approaches. For example, it will allow for the demonstration of practical examination results in an expedient fashion, which will enhance greatly the teaching value of the exam. It will also allow the creation of teaching learning experiences which utilize student participation to a greater degree. It can make possible treatment planning sessions and diagnostic sessions based on clinical material as it presents itself. The observation of technic laboratory material while the class is in session. It was agreed that the factor of spontaneity reinforced the learning value of a demonstration.

b. Actual dental instruction. It was agreed that like in other areas of pedagogy, TV can teach dentistry. It was pointed out

that in most instances TV was not at present being used to bring lectures to the student, but merely demonstration. When on the other hand this was necessary, there was no reason to believe this could not be done effectively.

C. Image transportation. Only TV can immediately transport an image from one part of a dental school to another. This was useful in allowing more students to view more clinical material.

2. In discussing what TV cannot do, it was decided that it cannot get to all parts of the oral cavity expeditiously with present equipment. At present, the state of the art limits TV in dental schools to monochrome. This must be considered a limitation in the presentation of certain material such as histologic slides, surgical cases, and soft tissue lesions. Also, the high degree of definition necessary to view certain material, such as the line angles of cavity preparation was not to everyone's satisfaction at this state of the art.

3. In discussing the merits of classroom TV and Studio TV, it was agreed that the equipment and presentation techniques must vary with the application and objectives. Therefore, it is necessary to define your objectives and to ascertain whether they are compatible with the objectives of the total academic program.

4. Finally, we agreed that you must plan carefully to initiate use of this media or the results will be discouraging and will impede progress in its application.

STUDY SESSION
ON AUDIO-VISUAL PERFORMANCE AIDS

by

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A performance aid is used primarily to remove reason and reduce decision making in accomplishing a given task. The use of a performance aid, as such, is limited in the practice of dentistry or medicine because of the high level of decision making that is necessary in these fields. However, by switching the objective from strictly task accomplishment to communication, a measure of learning can be achieved by the use of an audio-visual instrument.

The increasing use of audio-visual machines in industry demonstrates the applicability of this device to certain phases of medical and dental education. At this point, there is little literature on the use of audio-visual hardware in dental and medical teaching. These machines generally provide the means by which accurate information can be stored, retrieved and transferred, whether it be on local level or world wide in scope with the audio portion made suitable for the language of the area. The use of the audio-visual machines is no panacea for the problems of teaching and learning, but if the objective of the learning procedure is well understood, and the nature of the audience is known, then a well programmed lesson can be made. The machines can probably be put to best use where skill or manipulative training is desired, such as dental techniques or in areas where rote memory is involved, such as anatomy or histology. An area of learning in which the machine would be of doubtful value would be in the field of philosophy. Any phase in which there is a standardization of fundamental

principles of a given procedure will lend itself to the use of the A-V machines.

Learning or teaching situations which fall into these general categories have certain added advantages by being programed into the machines. It provides an opportunity for the student to learn at his own pace and to review the subject at his own convenience which can be done in an atmosphere remote from the traditional "classroom" or teaching environment. An earphone attachment provides an excellent learning environment by excluding the distraction of extraneous noises and allows the student to concentrate.

From the teacher's point of view, the A-V device has many advantages. It can allow him to evaluate his own material and update or upgrade as is necessary. By variations in the programing, the teacher can direct his material to the low 10% or the high 10% of the class or any intermediate grouping rather than be limited by the traditional methods. This allows the exceptional student to progress more rapidly through some of the more tedious basic subjects and permits the teacher more time to expand the horizons of this talented individual. This advanced group takes on new significance in the light of our new technologies and the need for these advanced "thinkers". One of the biggest advantages of this technique to the teacher is that it eliminates much of the repetition that is so boring and time consuming.

The sophistication of the A-V hardware is significant from the point of motivating the student to use the device. A simple film strip projector and record will serve the purpose, but if it is difficult to obtain or is unreliable in operation, then the student is not apt to be anxious to use the technique. If the instrument is

easily available, compact and portable and reliable in operation, the student is more apt to want to avail himself of the information contained in it. This mental attitude can even give a predilection to success or failure in the use of the machine. As was experienced in industry, the attitude toward the technique could determine the degree of success expected. This problem points up the fact that the objectives of the program must be carefully studied and determined as to whether they be within the realm of the A-V device or not, because a misapplied program will fail before it gets off the ground.

One of the big advantages that professional teaching has over industry is that we are not concerned to the same degree with the general attitude of the worker and of the student. The student is usually self-motivated to seek information and knows his progress in school is definitely related to the amount of information he has gathered, whereas, the industrial worker must be kept reasonably happy in his position to insure his attention to detail which pays off to the company in fewer remakes and greater profits.

Another advantage the teacher enjoys is that if he is successful he can remain in this same position which permits him to continue in this field of endeavor, whereas, a successful engineer who has the ability to think creatively and has solved a difficult problem is often moved up into management which takes him out of his most effective position.

Industry's success in the use of A-V devices has demonstrated the value of this technique of teaching. Certain selected courses of the dental and medical school curriculum can incorporate these techniques to advantage.

Respectfully submitted,
R. L. Eidson, D.D.S.
Co-chairman

STUDY SESSION
ON "TECHNIQUES OF AUDIO VISUAL MEDIA"

by

Mr. Howard E. Tribe, Study Session Chairman

The use of motion pictures in teaching was discussed first, and at the outset it was fairly well established that cost was one chief deterrent in the use of the motion picture film as a teaching aid, possibly because many educators usually think in terms of low budgets. However, the professional film producers feel that they have enough advantages to offer in improving the quality of the teaching film that the cost of professionally produced film is warranted. There was a feeling that the employment of the teaching film has not been developed anywhere near its capacity.

There is a need for a study of the efficiency and performance of the various teaching aids including the motion picture film which might be undertaken with the assistance of grant money. To obtain such grants the need would have to be proven to prospective grantors.

It was indicated that there are some films made without success, possibly by film makers who are not educators or by educators who are not film makers. The film makers expressed that a consulting service could possibly be offered at reduced costs.

A movement for the possible use of existing professional facilities and assistance, including Hollywood organizations, to become actively engaged in the production of teaching films was discussed. The success of such a program would largely depend on the solution to problems faced by the largest producers of education films now being made. The cold fact is that expenses must be met without subsidy. It must also be recognized that, for instance, in the

dental area there are less than about 12,000 students in training at one time, whereas in primary or secondary schools there are millions. The per student cost of producing dental teaching films may be prohibitive. Further study of the problem is obviously needed.

Comments on present methods and problems in audio-visual techniques were: (1) a lack of proper physical facilities for the employment of audio-visual techniques. Part of the problem is architectural. The blame was not laid to the architect but to a lack of communication between him and the planners for the use of facilities. (2) A definite lack of professional communicators to direct the development of the necessary preparation of audio-visual aids in the teaching programs. A person of this caliber should emerge to fill the void.

The committee did not find time to discuss applications of techniques presently used or contemplated. It was felt that such discussion would be valuable and that further conferences of this type should be planned.

GUIDE LINES FOR UTILIZATION OF PROGRAMED AUDIO-VISUAL INSTRUCTION AND RECOMMENDATIONS FOR FUTURE COURSES OF ACTION AND STUDY

SUMMARY, GUIDELINES AND RECOMMENDATIONS

The primary objective of this conference was to bring together the leading contributors of new techniques in instructional communication technology. During the course of the meetings, methods for applying these new techniques to the healing arts professions were discussed and evaluated. The reports submitted should stimulate further investigation into the problems confronting medical and dental education. While some of the tools for this task have been introduced, the need for further study is obvious.

It is recognized that teaching methods in medical and dental instruction have not kept pace with scientific advancements. Only in isolated instances have the professional institutions directed major attention to the newer educational media. There is an apparent lack of adequate communication between the professional schools which does not appear to exist in other branches of education. Concerted efforts should be made to reduce the barriers that prevent the sharing and acceptance of ideas and the introduction of newer methods of instruction.

Study sessions were organized within the conference to evaluate the various areas of activity and to make specific recommendations. The conclusions from these study sections and recommendations from the general conference are summarized as follows:

I PROGRAMED INSTRUCTION

Programed instruction is a methodology based upon established psychological principles of human learning and is an effective teaching technique. Research studies have proven its effectiveness, but unfortunately, too often this technique has been restricted to verbal learning. Programed instruction has been dramatically expanded beyond its earlier limits and now is widely used in the audio-visual field. Quality control is being more effectively applied to assure the use of sound learning principles.

It was the recommendation of this study section that:

- A. Faculties must be imbued with a tolerant, if not positive attitude toward automated teaching techniques. Negative attitudes of an inadequately oriented segment of the student population and reduces the effectiveness of educators who are attempting to teach with these proven techniques.
- B. In order to increase the probability of success for any particular program, a period must be provided in which there is closely supervised training and frequent consultation between programing specialists and the instructor (subject-matter expert). After such an orientation there still should be frequent collaboration with a skilled program editor in developing further programs.

- C. Three levels of instruction in medical and dental education were indicated:
1. In the freshman and sophomore classes greater emphasis is upon theoretical subject matter which encompasses a greater degree of rote learning. It was agreed that both linear and branched programing techniques were applicable at these levels.
 2. At the technical level where emphasis is upon motor skills it was suggested that linear programing techniques were most appropriate.
 3. With respect to clinical subjects during the junior and senior years where emphasis is placed upon problems of diagnosis and treatment, branched instruction techniques would be most effective.
- D. A major point of discussion dealt with the necessity for defining the objectives of any phase of programmed instruction. When these goals are established and programs are introduced, then adequate means for testing the students and evaluating the results of the program must follow.
- E. The group stressed that upon introducing programmed instruction techniques, pilot pre-testing precede introduction of the material to larger groups; also

that subject matter be limited to circumscribed aspects of a course; and that total reliance should not be made upon the programmed material alone.

- F. It was the opinion of the participants that good programs, which are carefully developed, can significantly contribute to the quality and economy of instruction. However, in order to obtain such programs, sufficient research and developmental efforts must be expended. Although grants-in-aid can provide for investigation and early experience, the teaching institutions themselves must assume the financial responsibility for continuing such activities.
- G. As the number of programs are developed and validated they must be given wide dissemination, so that collective critiques of the other institutions can be used as a basis for their improvement.
- H. Medical and dental schools require a central source of dissemination which would provide such information as:
1. Programs available
 2. Subjects in process of development
 3. Areas and subjects needing investigation in the future.

Aside from giving purpose and direction, it was felt

that a central information source would eliminate duplication of effort during this formative, exploratory period in programmed instruction.

- I. One area that remains to be researched more thoroughly deals with the unique situation of medical and dental students. Since factors of motivation, ability and attitude at professional school levels are somewhat dissimilar to those encountered in other areas of education, it may well be that revised concepts are called for and even at the undergraduate level it was suggested that these are relevant variables which require further investigation.

II CLOSED CIRCUIT TELEVISION

All types of subject matter are currently being taught through CCTV. The medium is used to teach every age group from kindergarten, through the university level. The results have ranged from dismal failures to outstanding successes. The salient point is that it is a teaching tool and an exceedingly versatile servant of education. It was evident throughout the conference that its effectiveness is greatest where effort, imagination and judgment are intelligently applied. Use of the medium as a tool in dental education is here to stay, but there exists a serious need to share basic knowledge relating to its

most effective use. There is a great deal of benefit to be derived in dental and medical education from the applications of the medium in the other fields.

- A. CCTV is being used in dental and medical education, primarily for immediate image magnification, (i.e., demonstrations of procedures, techniques and observations of clinical operations). The medium provides literally "front row seats" for an unlimited audience. Its value in effectively accomplishing this has been sufficiently established. Use of CCTV as a true teaching tool rather than as an image magnifier has been limited in medical and dental education.
- B. Knowledge of results on the utilization of CCTV as a true teaching tool in medical and dental education is urgently needed. A number of schools have expanded the medium to include programmed instruction. However, this conference had limited representation in this area. One of the speakers introduced to the conference the concept of maximum utilization of the medium and demonstrated how a research endeavor can be effectively accomplished. (Ref: Morrison, page 59).
- C. The importance of careful planning for installation cannot be understated. Factors to be determined are:
 - 1. What television can do in the utilization of
 - 2. Its relative costs

3. The equipment to purchase

4. How to operate it

A format must be developed and its effectiveness evaluated. Teacher and student attitudes toward a relatively new experience is a factor which must be analyzed.

D. Expanded research and wider dissemination of information concerning the above ideas are urgently needed.

III AUDIO-VISUAL PERFORMANCE AIDS

The research studies pertinent to programmed slide-tape instruction which were presented indicated significant potential for the medical and dental educator. In training situations involving both manipulative skills and rote memory, sequenced slide-tape programs appear to be particularly advantageous. Such programs are self-paced, and auto-instructional, thus permitting the student to proceed according to his own capacities. Through appropriate utilization of this system of instruction, the quality of teaching can be upgraded. Specific directions can be given for slow, intermediate or advanced students and the instructor can be freed from repetitious lecturing. An important factor to consider is that slide-tape programs are relatively economical to produce. It was an unanimous conclusion that further research in the utilization of

slide-taped instruction is imperative.

- A. Pilot programs and initial experimental studies have given sufficient evidence of the possibilities of success in using A-V aids of this type, but lack of sufficient programed material to round out an educational phase will hinder the acceptance of the technique.
- B. Programs must be comprehensive, self-contained, and non-fragmentary in nature so as to present the student with a meaningful body of information. This would permit the proper orientation of students who have not previously been exposed to this particular method of instruction.
- C. Further study should be made to determine the proper hardware required to meet the educational needs of various types of programs. A good program presented with the inadequate equipment can have a demotivating effect upon the student and may inhibit his learning.
- D. Mechanically reliable hardware must be made available to meet the requirements of various methods of presentation; it must also be economically compatible with academic budgets.
- E. A central agency should be established for coordinating the production of various types of programs, as well as

making available instructional materials produced by cooperating institutions.

- F. Close cooperation should exist between the instructor, the A-V specialist and the architect in order to provide an optimal environment for the use of the medium. Lighting, seating, sound control, ventilation, acoustics and signaling devices are critical factors to be considered in physical plant planning.

IV TECHNIQUES OF AUDIO-VISUAL MEDIA

There exists a definite shortage of professional communicators to direct the development of necessary audio-visual aids in teaching programs. Too often, educators assume this role, with resultant failure. On the other hand, audio-visual specialists often attempt educational assignments without proper consultation with the subject matter expert. Both groups must work together.

There is a wide range of audio-visual media available to the educator today. Among the more useful are:

- A. 8 and 16 mm. motion pictures
- B. 35 mm. color slides and filmstrips
- C. Printed pictures
- D. Art illustrations, cartoons
- E. Charts, graphs

- F. Overhead projection of large transparencies
- G. Opaque projection of printed matter
- H. Tape recordings, records
- I. Television
- J. Scale models, displays
- K. Bulletin boards, blackboards, flannel boards

- (1) The audio-visual efforts should be centralized to provide quality graphic, cinema and sound recording services. Where feasible, services may be provided by "within-house" staff. However, outside specialists and facilities should be utilized when warranted by practical consideration.
- (2) Small working conferences should be directed toward the study and evaluation of specified media and methods, and the the stimulation of cross-fertilization of ideas.
- (3) Workshops should be organized to acquaint educators with the problems of production, and use of selected media.
- (4) Studies should be made of both low and high budget productions to determine their relative teaching effectiveness.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

It was a major recommendation of this conference that a central source of information be established so that individual schools can be informed of the newer educational media and have access to these materials. The United States Office of Education is aware of this need for more effective disbursement of such information. The conference urges that further support be directed to medical and dental teaching institutions.

A salient point pervading the general sessions and working sections was the need for a central A-V department within each school and the assignment of a full-time media expert that would coordinate A-V and CCTV instruction in the school. Although foundation and governmental grants may serve as an initial impetus for such activity, it is incumbent upon teaching institutions to include such funds in their budgetary planning.

To prevent delay in the introduction of these technological advances in instruction, it appears that the organization and staffing of a central A-V department could occur prior to the development of materials. This would be a reversal of precedence for most institutions.

The consensus of the conference was that students within the current decade will be entering medical and

dental institutions with an increasing degree of exposure to "new media" methods of instruction. These "machine oriented" students will expect instructional training at the professional level to continue with, at least, a comparable degree of sophistication. Our professional schools must recognize this technological revolution and effectively prepare for the transition.